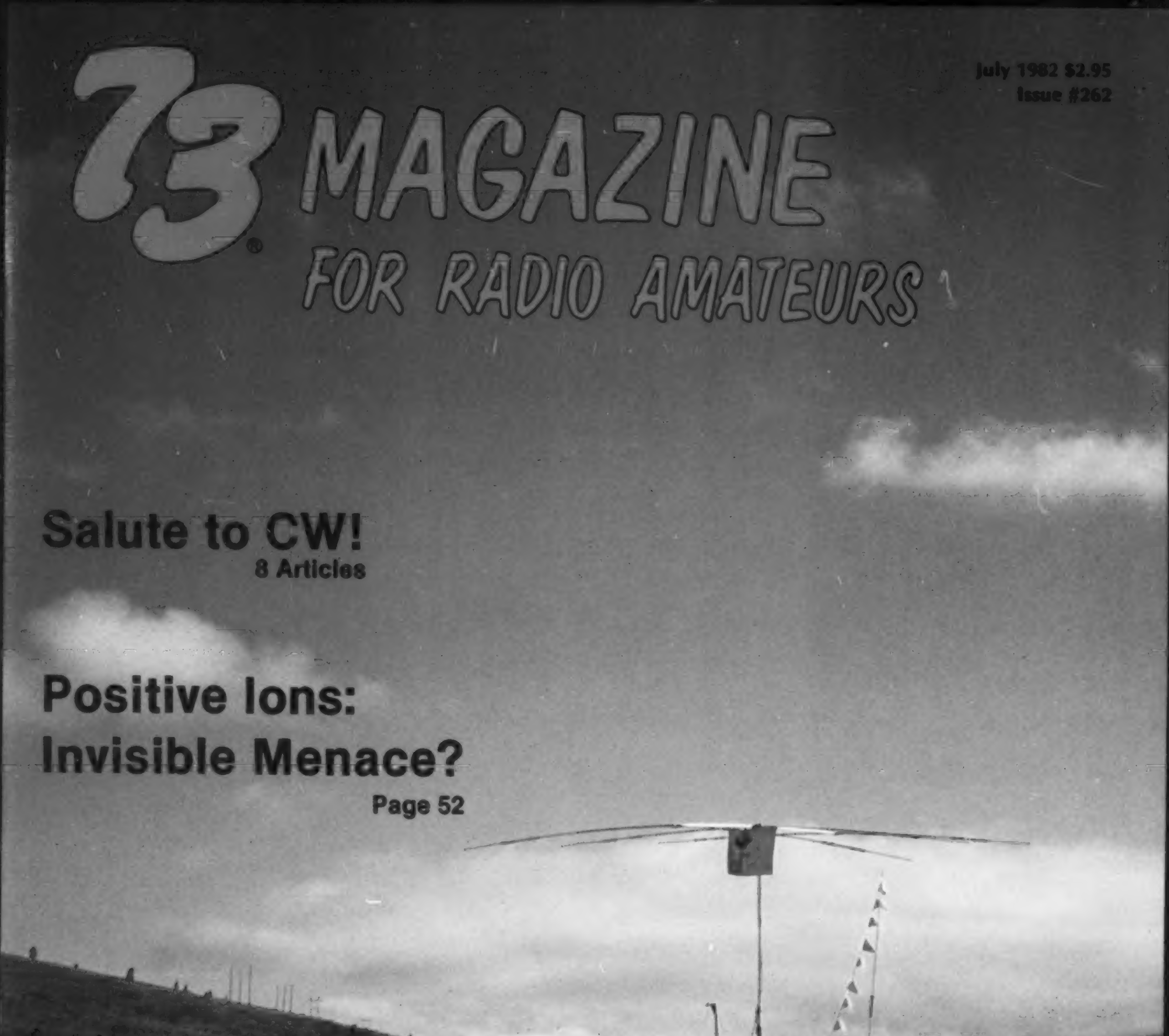

July 1982 $2.95
Issue #262

73 MAGAZINE
FOR RADIO AMATEURS

Salute to CW!
8 Articles

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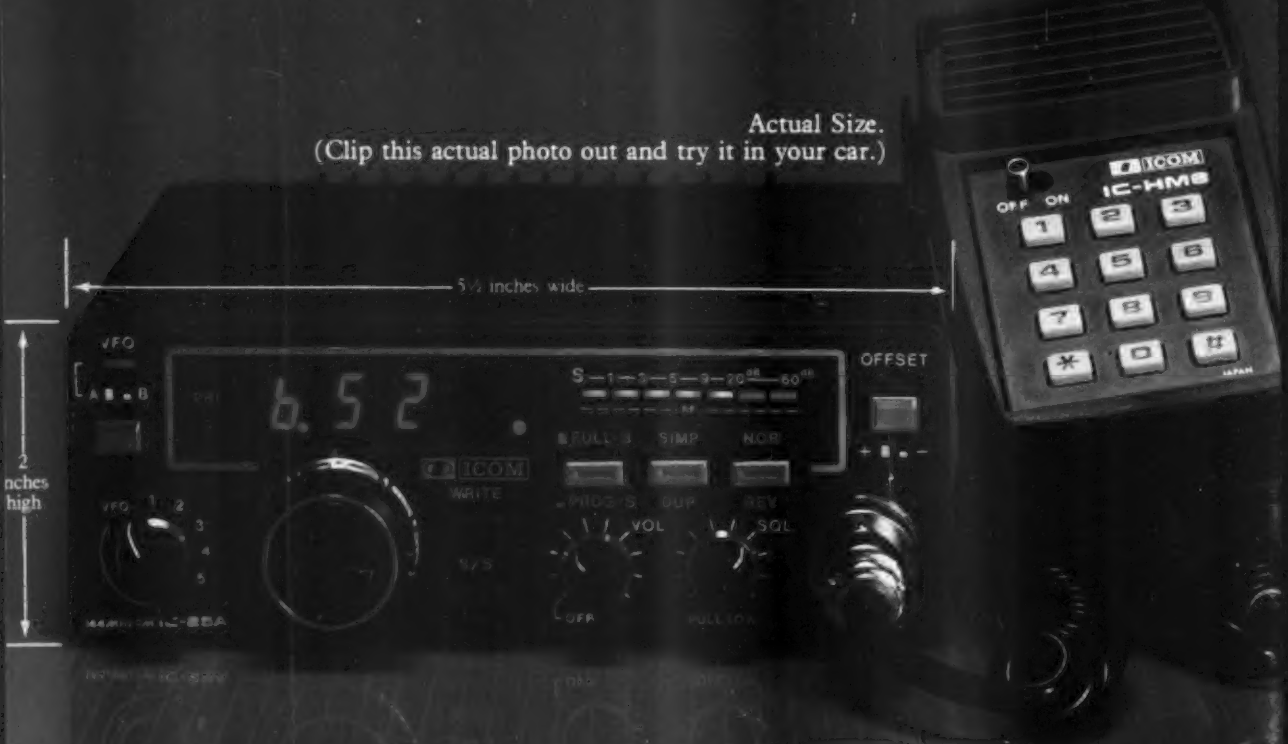
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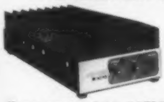

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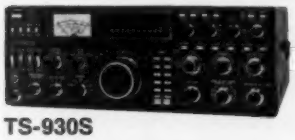
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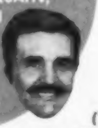

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Peterborough NH 03458
Phone: 603-924-7138

Circulation Offices:

Elm Street
Peterborough NH 03458
Phone: 603-924-9471

Subscription Rates

In the United States and Possessions:
One Year (12 issues) $25.00
Two Years (24 issues) $38.00
Three Years (36 issues) $53.00

Elsewhere:

Canada—$27.97/1 year only, U.S. funds. Foreign surface mail—$44.97/1 year only, U.S. funds drawn on U.S. bank. Foreign air mail—please inquire.

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Subscription problem or question:

Write to *73 Magazine*, Subscription Department, PO Box 931, Farmingdale NY 11737. Please include an address label.

73 Magazine (ISSN 0098-9010) is published monthly by 73, Inc., a subsidiary of Wayne Green, Inc., 80 Pine Street, Peterborough NH 03458. Second class postage paid at Peterborough NH 03458 and at additional mailing offices.

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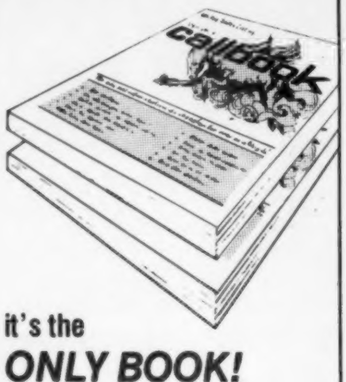

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Cover: Photo by F. Dale Williams K3PUR, Littleton CO.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

DAYTON '82

It isn't just the flea market with over 500 small entrepreneurs selling out of their trucks, campers, and cars. It isn't the nearly 200 exhibitors inside the rambling Wampler's arena. It isn't the 25,000 or so hams and their families which descend upon Dayton in April every year. Pandemonium.

Whenever I hear about some hamfest or a computer show pulling 20,000, I think of what it takes to handle the crowds at Dayton and how many people this really is all in one area. The fields are packed with cars for a half mile or so around the arena area. The cavernous arena buildings are packed with people. No matter how many there are inside, it seems as if the flea market area outside is still so busy that it is difficult to get around.

Dayton attracts average hams from several nearby states. But more than that, most of the real "movers" of the hobby . . . the hams who are doing the building, the inventing, the pioneering . . . come from everywhere in the country. These are the hams who make amateur radio the incredible hobby that it is.

Other hamfests may have technical sessions, but these are attended by merely interested amateurs. At Dayton, the attendance of these tech sessions is made up of the hams who are doing things. Here, one gets to say hello to the top DXers, the DXpeditioners, the slow-scan three-dimensional color experimenters, the packet switching fanatics, and the spread-spectrum aficionados.

While several of the other larger hamfests have gone to rather great lengths to bring in computer-oriented exhibitors, Dayton has maintained a straight ham approach which has kept this field of ham activity at a relatively low profile. Yet this year, when we counted the exhibits, we found that about 15% of them were computer-oriented. This is low, of course, compared to the computer interest in the ham world. Our most recent survey of the *73* readership showed that the ownership of microcomputers is up to 39% now. In another year perhaps 50% of the readers will have microcomputers.

I tried to give a talk during the hamfest, but the meeting "room" was so terrible that I gave up. The temperature was well into the sleep zone and the noise was such that someone three feet away had trouble hearing what was going on. The area was just one part of a huge building, with deafening noise coming from all sides. I don't think I'll try that again. I'll bet it was 90° or more in the room, with only enough seats for about 70% of those who came to hear me.

My talks are generally rather low key, with some time required for the humor to come through. I do speak about serious things, but I don't take many of them seriously. And I don't do well when I have to communicate by yelling at people.

I'll no doubt continue to go to Dayton, but only to say hello, find out what's new, and get together with my friends in the industry.

HARRY, WHERE *ARE* YOU?

Missing for the first time in years at Dayton was the flushed cherubic face of Harry Dannals. I, for one, am sorry to see good old Harry go. And I have to admit that I was darned upset when I learned that the ARRL board just plain outright dumped him. Now what would it have cost them to be nice about it and give him a President Emeritus position?

Dick Baldwin, also not visible at Dayton, seems to have fallen in the same black hole now occupied by Harry, but at least with a face-saving title to make it look better. That's what they did with John Huntoon when the power politics at HQ dumped him a few years ago. Anyone remember John?

You know, one of the surprises I got when I went around to visit some wealthy hams back in 1960 had to do with Dick Baldwin. I'd been fired by *CQ* as editor and had this crazy idea of starting my own ham magazine. I was hoping to find a ham with enough money to get a new magazine started. One chap I visited said he thought the idea was a good one, but that it was too dependent upon just one person: me. He was right about that, of course. He also mentioned that Dick had been around with a similar proposition a few days before.

I dropped Dick a note asking if he might be interested in a joint venture. He wrote back saying no. Well, I went ahead without any financing and Dick never did. Oh, it was nip and tuck for several years, particularly when the ham business fell to pieces after the 1963 ARRL proposal for changing the licensing structure back to the 1930s form. That's when we lost 85% of the sales of ham gear in just one year and all of the major manufacturers were forced out of the industry.

The ten years after that of no growth were hard ones for me and *73*. It wasn't until I managed to sell the idea of FM and repeaters that the industry (and *73*) turned around.

Harry, who had retired from his job at Sperry in order to be available for the General Manager's position, may have to unretire. I wonder what went wrong for him? I'm told by the ARRL insiders that he performed the most exhaustive campaign for the job in history . . . at League expense. Perhaps it was his bitter opposition to having a woman on the board. Well, no matter . . . Harry is well out of the rat race and the demands of the ARRL presidency. I was worried that the even greater pressures of being General Manager might be too much for him. Perhaps he can relax now and add at least twenty years to his life. This may be the best thing that has happened to Harry in years . . . instead of the disaster which it first appears.

INSTANT LICENSES

At long last a solution to the code exam has been effected. Now it is no longer necessary

VOLUNTEERS NEEDED

How would you like to be on the "inside" of a major amateur radio contest? Here's your chance!

We're looking for volunteers to become members of the *73 Magazine* Contest Committee. Anyone with an interest in contesting and a willingness to work hard is welcome. Committee members will help with the following:

1. Contest rules and ethics.
2. Forms and correspondence.
3. Log checking and scoring.
4. Filling out and mailing awards.

Heading up the Contest Committee is Bill KE7C. Please drop Bill a note (with SASE) and let him know where you can help. Write to Bill Gosney KE7C, *73* Contest Committee, 2665 North Busby Road, Oak Harbor WA 98277.

We want *you* on the *73* Contest Team!

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40 W, 15 memories/offset recall, scan, priority, DTMF touch-pad

TR-7850

Kenwood's remarkable TR-7850 2-meter FM mobile transceiver provides all the features you could desire, including a powerful 40 watts RF output. Frequency selection is easier than ever, and the rig incorporates new memory developments for repeater shift, priority, and scan, and includes a built-in autopatch touch-pad (DTMF) encoder. A 25-watt output version, the TR-7800, is also available.

TR-7850 FEATURES:

- **Powerful 40 watts power output**
  Selectable high or low power operation. High 40-watt output provides reliable signal for wide area coverage.
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  M1-M13 ... memorize frequency and offset (±600 kHz or simplex). M14 ... memorize transmit and receive frequencies independently for nonstandard offset. M0 ... priority channel, with simplex, ±600 kHz, or nonstandard offset operation.
- **Internal battery backup for all memories**
  All memory channels (including transmit offset) are retained when four AA NiCd batteries (not Kenwood supplied) are installed in battery holder inside TR-7850. Batteries are automatically charged while transceiver is connected to 12-VDC source.
- **Extended frequency coverage**
  143.900-148.995 MHz, in switchable 5-kHz or 10-kHz steps.
- **Priority alert**
  M0 memory is priority channel. "Beep" alerts operator when signal appears on priority channel. Operation can be switched immediately to priority channel with the push of a switch.
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  Front-panel touch pad generates all 12 telephone-compatible dual tones in transmit mode, plus four additional DTMF signaling tones (with simultaneous push of REV switch).
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  For frequency selection, transmit offset selection, memory programming, scan control, and selection of autopatch encoder tones.
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  Entire band (5-kHz or 10-kHz steps) and memories. Automatically locks on busy channel; scan resumes automatically after several seconds, unless CLEAR or mic PTT button is pressed to cancel scan.
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for anyone to bother to learn even one single character of the Morse code to get a ham license. The solution to the code problem is so simple I'm amazed that no one ever thought of it before. Once you get the concept, you see that we no longer have to argue about the code.

At Dayton someone was selling a cassette with the FCC code test on it. With today's miniature cassette recorders it is a snap to have one in your pocket and record the tests as they are being given. Well, someone did this and was selling the tapes at Dayton. Once you have that all you have to do is get someone to translate it for you, memorize the short text, and present yourself for the test.

The FCC is so underpowered these days that they really don't have the personnel to devise a lot of different tests. I'll bet that at best they have maybe two for Morse code, if that many. There are no indications that the Commission is going to get more money from Congress, so it is unlikely that there will be much doing in the way of changes.

So, by the time you put the Bash books together with a cassette of the code test, you have a ham license that anyone who can read and write can get. No more is there a need for that tedious learning of the code. No more struggling with theory or the rules. Bash gives you the answers to the written exam and the code cassette solves that problem.

Who will be the first Extra to get licensed with no ham knowledge whatever? Or perhaps I should ask, who *was* the first?

As a humorous side note: the FCC recently was handed a code test exam which was 100% perfect. Well, perhaps *almost* perfect. You see the answers were perfect for the *other* test . . . not the one given.

WE NEED KIDS

With all due respect to Bash and his one-day blitz cram courses, at $175 for one day it is unlikely that we are going to get many kids into the hobby via this mercenary system.

Now, I have the greatest admiration for Bash and his bid to outdo Don Miller in making money out of amateur radio. I'm sure he will find no shortage of well-to-do hams who want to get a higher license without having to learn one bit of theory. Just ten of his weekend sessions a year should net him around $150,000. One really has to admire that, no matter what the consequences to the hobby.

FCC DELETES 97.71 AND 97.74

"Unenforceable, burdensome and unnecessary" is how the FCC described 97.74, a rule requiring amateurs "to provide for measuring the station's emitted carrier frequency and to establish procedures for independently checking it regularly." In their April 1 meeting, the commissioners voted to delete 97.74 and 97.71, a rule which required transmitters operating below 144 MHz to have adequately-filtered plate power supplies. In deleting 97.71, the Commission said "the rule itself is inappropriate and outmoded."

His system is simple and it works. He sits you down for a full day of memorizing the answers to the questions. He has you write down the answers you are going to need the following day on the exam . . . write 'em two or three times to make sure they are well-established in your short-term memory. As an aspiring General or Advanced, you can't lose. Neither can Bash.

All this has absolutely nothing to do with the major crisis in amateur radio: the need for new hams. Novices . . . teenagers. We already have all of the old men we need in amateur radio—now what we need is to see about 100,000 new Novices per year to get our rusty old hobby jumping again. That would spur technical developments and building (kids really love to build) and get some life into things.

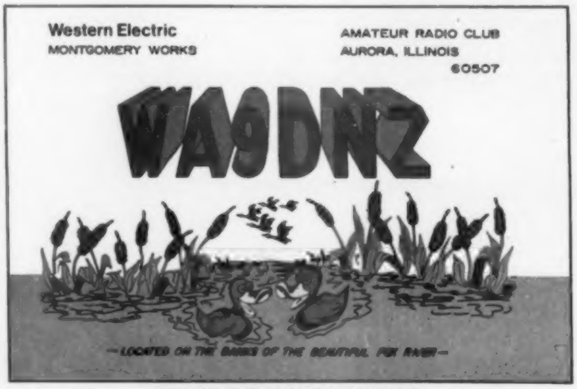
What has your club done to get a ham group started in the local high school? If we don't even give the kids a chance to be exposed to amateur radio, we have no gripe when they turn to drugs, drinking, getting into car accidents, malicious destruction, spray painting everything in sight, and getting all of your girls pregnant. At least give them an alternative!

NAVASSA TIME

The May 3rd issue of *Time* had a nice article on the recent hamming of Navassa Island. As one of the few persistent (stupid) enough to go there twice, I read the item with more than average interest.

The first trip, in 1958 (KC4AF . . . a call now held by a chap in Alabama), saw six of us chartering a motor-sailer in Nassau and making our way down the Bahamas to Haiti through a heavy storm. We just barely missed crashing on a reef when we got to Haiti before dawn. It was a hell of a trip and we found ourselves about 50 miles off course by the time we

Continued on page 118



QSL OF THE MONTH: WA9DNZ

The natural theme of the Western Electric Montgomery Works club station comes from the plant's location on the Fox River. Built on the site of a former amusement park, the factory is in a wooded setting and sports a year-round duck population. The card's bright colors are sure to catch the eye of the operator on the other end.

Entirely professional level!
You'll find the difference the more you use it.
ULTIMATE QUALITY, NRD-515

NDH-515
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NRD-515
ALL WAVE RECEIVER
TUNE
LOCK

Receiver, NRD-515

SPECIFICATIONS

Receiving frequency range:	100kHz to 30MHz continuous (30 bands)	
Receiving modes:	USB/LSB/CW/RTTY/AM	
Receiving system:	Up conversion type Double superheterodyne First IF: 70.455MHz	
Sensitivity (S/N 10dB):	CW/SSB	AM
1.6 to 30MHz	0.5μV	2μV
100 to 1600kHz	2μV	6μV
Selectivity:	6kHz/2.4kHz/0.6kHz*/0.3kHz* (*Option)	
Stability:	Within 50Hz/one hour	
Power requirements:	AC 100/117/220/240V, 50/60Hz, 50VA	
Dimensions and Weight:	340mm(W)×140mm(H)×300mm(D); Approx. 7.5kg	
Preset memory (Option):	24ch.	
Frequency stability:	Less than 50Hz per hour after warming up.	
Image rejection ratio:	70dB or more	
IF rejection ratio:	70dB or more	
Input impedance:	50 to 75 ohms, unbalanced	
AF outputs:		
Speaker output:	1W or more (4 ohms)	
Record/line output:	1mW or more (600 ohms)	

Highest grade all-wave receiver

NRD-515

Best for 59

Transmitter, NSD-515

SPECIFICATIONS

Rated output power:	100W NSD-515 (50W 28MHz band)
Frequency range:	1.8MHz-2.0MHz/3.5MHz-4.0MHz/7.0MHz-7.3MHz/14.0MHz-14.35MHz/21.0MHz-21.45MHz/28.0MHz-29.0MHz/29.0MHz-29.7MHz/Optional new bands approved by WARC '79 10.1MHz-10.15MHz/18.068MHz-18.168MHz/24.89MHz-24.99MHz/
Mode of emission	A3J (USB/LSB) A1 (CW) F1 (RTTY)

- For more information please contact to;

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The ultimate team...the new Drake "Twins"

The TR7A and R7A offer performance and versatility for those who demand the ultimate!

TR7A Transceiver

• **CONTINUOUS FREQUENCY COVERAGE** — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• **Full Passband Tuning (PBT)** enhances use of high rejection 8-pole crystal filters.

New! **Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard,** plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical/electrical design result in realizable ultimate rejection in excess of 100 dB.

New! **The very effective NB7 Noise Blanker is now standard.**

New! **Built in lightning protection** avoids damage to solid-state components from lightning induced transients.

New! **Mic audio available** on rear panel to facilitate phone patch connection.

• **State-of-the-art design** combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

R7A Receiver

• **CONTINUOUS NO COMPROMISE 0 to 30 MHz frequency coverage.**

• **Full passband tuning (PBT).**

New! **NB7A Noise Blanker supplied as standard.**

• **State-of-the-Art features** of the TR7A, plus added flexibility with a low noise 10 dB rf amplifier.

New! **Standard ultimate selectivity choices** include the supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• **Front panel pushbutton control** of rf preamp, a-m/ssb detector, speaker ON/OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

The "Twins" System

• **FREQUENCY FLEXIBILITY.** The TR7A/R7A combination offers the operator, particularly the DX'er or Contester, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A

• **ALTERNATE ANTENNA CAPABILITY.** The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

Specifications, availability and prices subject to change without notice or obligation.

DRAKE

See your Drake dealer or write for additional information.

COMING SOON: **New RV75 Synthesized VFO Compatible with TR5 and 7-Line Xcvrs/Rcvrs**

• Frequency Synthesized for crystal-controlled stability • VRTO (Variable Rate Tuning Oscillator*) adjusts tuning rate as function of tuning speed. • Resolution to 10 Hz • Three programmable fixed frequencies for MARS, etc. • Split or Transceive operation with main transceiver PTO or RV75

R. L. DRAKE COMPANY • 540 Richard Street, Miamisburg, Ohio 45342 • Phone (513) 866-2421 • Telex 288-017

* Patent pending

New Drake TR5 Transceiver

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RV75 Synthesized VFO
featuring the Drake "VRTO"

• **Frequency Synthesized** for crystal-controlled stability • **VRTO (Variable Rate Tuning Oscillator*)** adjusts tuning rate as function of tuning speed. • **Resolution to 10 Hz** • **Three programmable fixed frequencies for MARS, etc.** • **Split or Transceive operation with main transceiver PTO or RV75**

* Patent pending

With the new TR5
versatility and value are spelled D-R-A-K-E . . .

DYNAMIC RANGE

The dynamic range of the TR5 is unexcelled by any transceiver in its class. The TR5's greater than 0 dBm third order intercept point (85 dB two-tone dynamic range) at 20 kHz spacing can be achieved only by the use of a passive diode-ring double balanced mixer. Drake was the first to bring this technology to the Amateur market with a high-level mixer in the TR7.

RELIABLE SERVICE

When you purchase a TR5, or any Drake product, you acquire a product of the latest production techniques, which provide reliable performance.

Yet with a product as sophisticated as one of today's transceivers, after-sales service is a must. Ask any Drake owner. Our Customer Service Department has a reputation second to none.

ACCESSORIES

Drake is the only Amateur Radio manufacturer who offers a full complement of accessories to satisfy almost every desire the HF Amateur may have. This wide selection allows any operator to assemble a station which meets his needs, and assures compatible interfacing and styling instead of a desk full of equipment with a variety of styling and poor operation as a system.

KILOWATT AMPLIFIER

Everyone wants to be heard! The accessory L75 and its 3-500Z (1200 watts PEP input) and a decent antenna will do the trick. This rugged self-contained amplifier/power supply will put the TR5 on an even footing with the best of them.

ENGINEERING

The TR5 and all Drake Transceivers, are backed by the best in engineering. The TR5 is the result of an extensive engineering effort, combining proven past techniques and ideas with new state of the art concepts.

As a result, the TR5 will not be superceded by a new model every six months. It represents a true radio communications value that will provide many years of operating enjoyment.

Features, availability and prices subject to change without notice or obligation.

See your Drake dealer
or write for
additional information.

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Log of the Colorado Queen

—wet, wild Field Day fun

F. Dale Williams K3PUR
5592 S. Moore Street
Littleton CO 80127

Spring, as reflected in the short-lived green sheen of the foothills, was well settled in the Rocky Mountains when the members of a Denver area amateur radio club gathered to discuss the 1978 Field Day activities. The interests of the club had varied over the years, but the recent increased appeal of contesting and the technical antenna expertise promised in the form of a full-size 40-meter beam to help fill in the propagation holes in 10-20 meters convinced the membership to go all out for top spot in the Field Day results.

Without debating the good and bad points of Field Day, suffice it to say that participation can be divided into two broad classifications—high key and low key. Those groups scoring high obviously are in the high-key category which describes the organization, planning, and pressure required. The pursuit of a hobby is supposed to be fun and the belief that a sense of personal accomplishment could be achieved without the peer pressures for maximum contacts led to the breakaway, following the 1978 Field Day activities, of five members of the club who subsequently formed "the crew."

When the crew, consisting of Al N0AUS, Pete N6EBC (ex-WD0BJY), Gary WD0GGL, Glen WD0FEO, and Dave WB8KYP, meets, they have only two goals: having fun and planning technical projects which some people say can't be done. It was this attitude that prevailed at the first meeting of the group where plans were formed to construct a floating all-band station. Once the concept was agreed upon, it became obvious that this vessel would require a name befitting its heritage. Since N0AUS had a thing for the *African Queen*, having seen the movie more times than he could remember, it wasn't long before the group came up with some apropos phonetics and a name: CQ, the *Colorado Queen*.

During the winter, plans for a 1979 summer launching were made with reckless abandon and much beer. Chatfield Reservoir, south of Denver, at an elevation of 5432 feet, was chosen as the site of operations and WD0FEO offered the use of his 10-man white-water rubber raft as the ship of destiny. As might be expected, the selection of a suitable antenna and how to mount it to a rubber raft were the biggest problems. The final solution involved a 14AVQ all-band vertical, owned by WD0FEO, and a floating platform. A hollow steel pipe and flange were attached to the center of a large diameter circular section of plywood through which a hole had been drilled in the center. Three 900 x 16 truck inner tubes were mounted under the platform to provide flotation and stability; three outriggers, emanating from the

The crew and the Colorado Queen *preparing to begin the weekend operations.*

WB8KYP readies the triband beam for a little more height.

The backup Kenwood, unloaded by WD0FEO, provided flawless operation.

platform and made from 2 x 4 x 12s, supplied guy points for the vertical which was attached to the pipe. A long cable connected to and extending through the center of the pipe into the water served as system ground. Support framework for the equipment and personal gear was ably constructed through the experience of WD0FEO and the crew's labor.

Now consider, for a moment, a 14-foot rubber raft powered by a 3.5-horsepower motor towing the antenna platform just described with the vertical via a 30-foot rope. While underway, the floating antenna platform maintains its distance, but when the raft is stationary, the weight of the rope and coax connecting the rig on the raft to the antenna tend to draw the platform closer as the cable sinks into the water. A number of four-inch styrofoam balls, with a hole cut through the center for the coax, solved this problem and prepared the *Queen* for her August 18th inaugural voyage.

With a Yaesu FT-101EE powered by two paralleled lead-acid batteries, various 2-meter hand-helds, assorted swr meters, and other gear on board and an appropriate christening with white lightning, the historical launching of the first mile-high freshwater mobile took place amidst the curious gazes of swimmers, boaters, and sunbathers. During the weekend of operation, many contacts were made, lots of time was spent ragchewing as opposed to exchanging callsign, signal strength, contest number and best wishes, and most important of all, a fun time was had by all, including WB8KYP who towed a stranded cabin cruiser back to shore with his "shuttle canoe" and paddle power. The only casualties, other than operator sunburn, on this first voyage were a waterlogged 2-meter hand-held and damp finals in the FT-101EE.

It is a well-known fact that the higher the antenna, the better the communications. Therefore, Green Mountain Reservoir, at an elevation of 8200 feet, was chosen by the crew for the 1980 launching of the *Colorado Queen*. Besides that, WD0FEO offered the use of the family cabin for a weekend of revelry. The same basic raft and antenna platform were used with some extra framing and plywood floor added to the raft for rigidity and the addition of equipment boxes to preclude some of the water problems encountered the previous year.

After a successful launching and an uneventful morning of operation, the crew was languishing on the deck, contemplating the relative merits of Coors beer, better known as Colorado Kool-Aid, when the capricious mountain weather made one of its abrupt changes. In less time than it takes to QRX, the sun disappeared and 70-mile-per-hour winds whipped the surface of the water into a rough pattern of whitecaps. Since the closest land was in the form of an island, the crew cranked up the 3.5 pony-power engine and headed the *Queen* for the leeward side. The bamboo mast supporting WD0FEO's 2-meter beam split with a resounding crack and the antenna was fished out of the drink by means of the still attached coax.

When the island was finally reached, everyone disembarked to attempt to find some shelter. It was a short time later when it was discovered that no one had dropped anchor or tied up the raft, which was now making good time away from the island. Luckily, the shuttle canoe was still on the shore and the chase began. In the ensuing recovery, to add insult to injury, WD0FEO's ten-gallon hat was blown into the water where it promptly sank beneath the waves. Repeated efforts to recover this well-worn relic were all in vain, although WB8KYP swears he saw a catfish wearing something similar as it jumped in front of the raft.

No sooner was the raft secured back at the island than some crew members decided that the original cargo of three cases of beer was fast being depleted and some suntan lotion to soothe the morning's ultraviolet onslaught was in order. What is it they say about discretion being the better part of valor? Anyway, WD0GGL and WB8KYP volunteered to take the canoe and attempt to refurbish the supplies. In an adventure about which the residents along the shoreline still chuckle, these two stalwarts paddled and bailed their way to the far shore, in the only vessel on the water, oblivious to the binocular-equipped audience watching from the many windows on land. Reportedly, the trip back to the island after obtaining the necessary replenishments was much easier with the wind at the rear. Sunday dawned bright and clear, providing a fine atmosphere for the conclusion of that year's freshwater operation with only a Yaesu 2-meter rig sustaining water damage and WB8KYP once again coming to the rescue of a stranded cabin cruiser, but this time he was prepared (?) with a 1.7-horsepower Neptune engine mounted on his shuttle canoe.

By 1981, the crew was looking for bigger and better challenges to conquer with the *Colorado Queen* and had made the operation an annual event taking place the weekend following the July 4th holidays. Commensurate with the arrival of spring, the crew, minus N6EBC who had been transferred to California, gathered to begin construction of the latest version of the *Colorado Queen*.

Over the winter months a new design for the antenna platform had evolved, made necessary by the decision to use WB8KYP's TH-3Jr. triband beam. WD0FEO had managed to find a small boat dock which had four 50-gallon drums attached underneath for flotation and steel-rimmed wheels mounted on the sides for easy water entry and exit. Six 900 x 16 truck inner tubes were added for stability and two 2 x 4s for attaching the floating dock to the framework of the raft. Three holes drilled at the center of the dock allowed the mounting of a steel tower section which was guyed to the four corners of the dock superstructure. The mast was then slipped through the tower pipe and the triband beam mounted on top. Enough mast was used to allow the antenna to be raised between six and fifteen feet and still offer the capability of armstrong rotation.

The first test of this water mobile antenna barge almost drowned two of the crew due to its top-heavy attitude. Subsequently, an exercise with a local firm's Computer Aided Design equipment showed that a 180-pound counterweight suspended nine feet below the water line would stabilize the platform. Oh, the wonders of modern technology. The counterweight was constructed and made adjustable so that it could be raised when approaching the shore or lowered to 14 feet for windy conditions.

As the weekend of July 11-12 drew closer, construction activity intensified. Boxes to hold the lead-acid batteries were built, a bracket assembly to provide mounting of the 14AVQ to the raft frame for 40- and 80-meter operation was completed, and white paint flowed freely.

By the time launch day 1981 arrived, the crew had put in at least 480 man hours in labor alone. The arrival in Denver of N6EBC a few days prior to the weekend signalled the imminent pack-up and departure of the crew for the mountains. Assembly of all the miscellaneous parts, all prepared and marked beforehand, took about two hours on Friday.

Meanwhile, N6EBC had brought along some Santa Maria beans from California which he put in a borrowed enamel pot, then adding some "miscellaneous condiments" before placing them on the gas-modified woodstove to cook. I have been known to prepare some pretty bad-looking vittles, but I have never seen anything eat the enamel off the inside of the pot like those beans did. Thank goodness the sirloin roasts with the secret flavoring, barbecued over an open oak fire, were really good.

Bright and early Saturday morning, the rigs and equipment were loaded into the raft and hooked up and the third annual launching of the *Colorado Queen* became history—or so it was

WD0GGL relaxes as the sun tries to burn off the early morning mountain mist.

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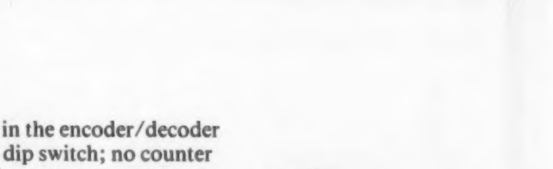
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IC-107
LM-324
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IC-107

SS-32 $29.95, TS-32 $59.95

From the operating position, N6EBC and N0AUS divide their activities between testing 807s and logging contacts.

supposed to be. Output power from the Yaesu FT-101B was almost nil and the LEDs on the front of the Icom 2-meter rig would not even glimmer. Power connections were checked and rigs exchanged without success. Finally someone got the bright idea of measuring the voltage of the batteries. Eureka, a brand new heavy-duty battery had a shorted cell and was pulling the parallel battery combination down to about 8.5 volts. The extra drain on the good battery limited current capacity for the day's operation, even after the bad battery was replaced.

Late Saturday afternoon some clouds moved in and the wind picked up, causing a slightly earlier than usual beaching of the *Queen* for the first day. A Kenwood TS-520S was put in service Sunday morning but the skip was not too long, with most of the QSOs originating out of the eighth call area. Shortly before noon on Sunday, the clouds and wind returned from the opposite direction and the smell of ozone in the atmosphere indicated a high level of static electricity. As WD0FEO guided the floating station into the dock, the static build-up became so bad that a humming and discharge clicking were clearly audible, but the antennas were grounded and the equipment was removed without incident. Despite these technical problems, poor band conditions, high wakes from power boats pulling water skiers (which made the triband elements flap through a three-foot arc), and the many visitors that WB8KYP shuttled back and forth in his canoe, the two days of freshwater mobile operation, gourmet food, and 14 cases of beer made for an unsurpassed weekend of camaraderie and enjoyment.

What will the crew do for an encore? Well, plans are already underway for the construction of a motorized dock large enough for the TH-3Jr. at 30 feet, the 14AVQ vertical, a 2-meter mast and five-eighths groundplane, a gasoline generator, a Model 35 Teletype, three operating positions, and many creature comforts. When not in use, the dock will serve its normal purpose.

If you didn't manage to get your call letters entered into the log of the *Colorado Queen* for 1981, you missed the opportunity of receiving a fine 8 x 10 color picture QSL card. Mark your calendar now for July 10-11, 1982 —the crew will be listening for you. ■

***BEC* Bullet Electronics Corp. P.O. Box 401244E Garland, TX. 75040 (214) 278-3553**

⌐12

THE PRESIDENT SAYS: "HOGWASH!!"

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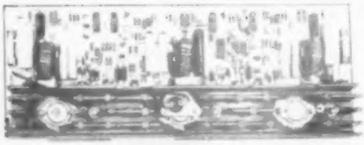
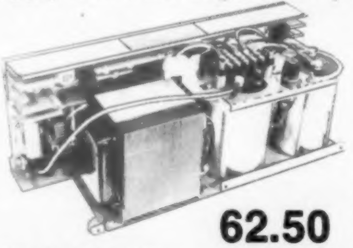


REGULATOR ASSEMBLY
(part of unit)



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3 OUTPUTS
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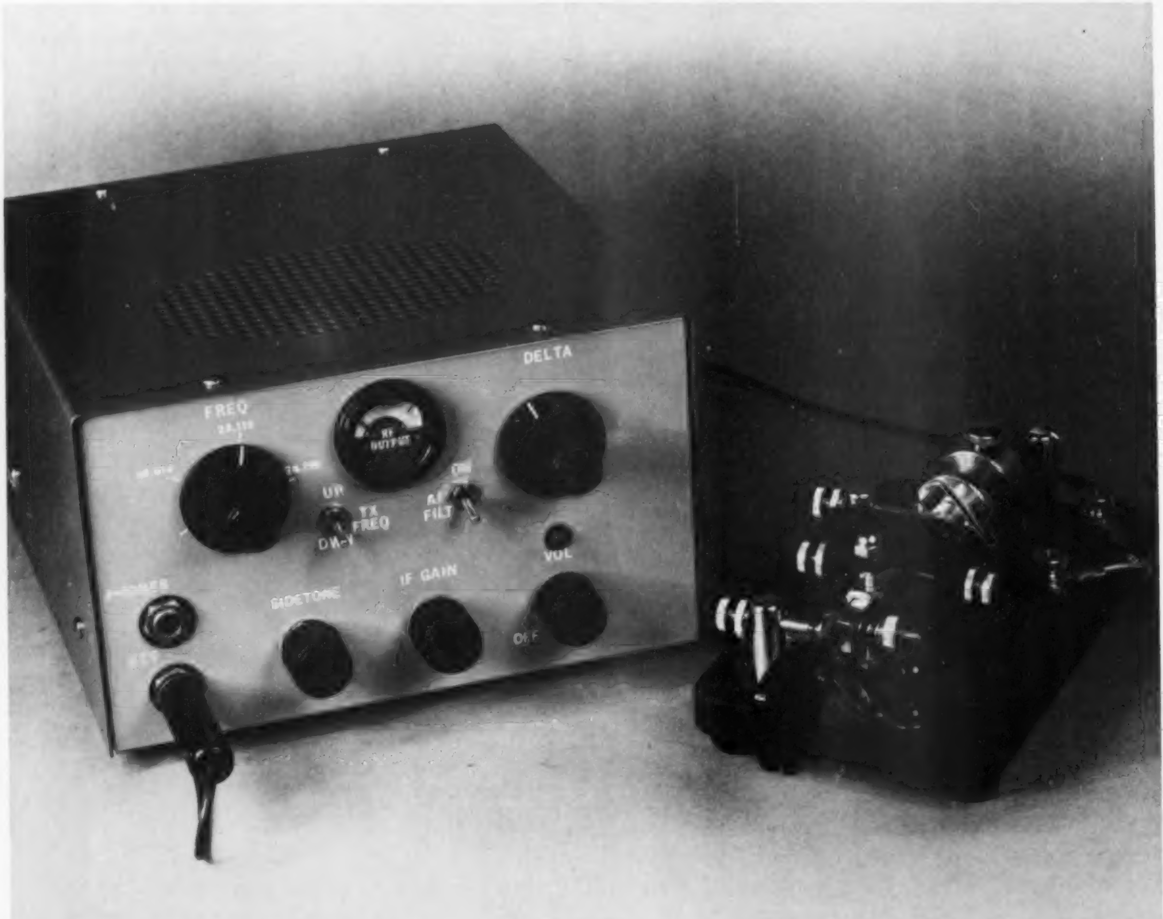
CB to CW?

—converting the Hy-Gain board

Photos by W1GSL


FREQ
DELTA
RF OUTPUT
UP
TX FREQ
DN
AF FILT
VOL
IF GAIN
SIDETONE
OFF

Operator's view of the transceiver. Note the insulating washers around the key and phone jacks. The internal dc power ground is floated from the cabinet to permit use of an external supply of either polarity. Front panel is 7" × 4".

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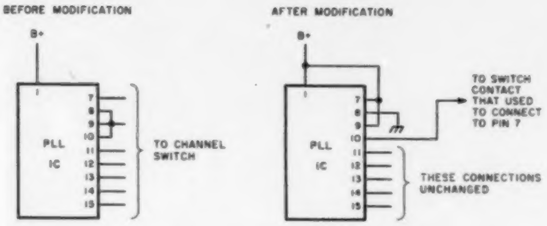

BEFORE MODIFICATION
B+
1
7
8
9
10
11
12
13
14
15
PLL
IC
TO CHANNEL SWITCH
AFTER MODIFICATION
B+
1
7
8
9
10
11
12
13
14
15
PLL
IC
TO SWITCH CONTACT THAT USED TO CONNECT TO PIN 7
THESE CONNECTIONS UNCHANGED

Fig. 1. Channel selector modification.

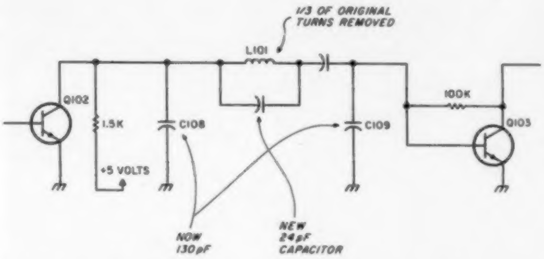

1/3 OF ORIGINAL TURNS REMOVED
L101
Q102
1.5K
C108
+5 VOLTS
C109
100K
Q103
NOW 130pF
NEW 24pF CAPACITOR

Fig. 2. Modifications to increase bandwidth of low-pass filter.

If you're one of the thousands of hams who bought one of those Hy-Gain CB set printed circuit boards for a song when they appeared on the surplus market, then this may be the article you've been waiting for. Described here is a neat little ten-meter CW rig that boasts a feature you won't get in the standard HF transceiver: full break-in. The rig is built around the Hy-Gain board and is inexpensive to duplicate. You don't have to buy any new crystals or exotic ICs; in fact, the design philosophy has been to add nothing which couldn't be found at the local Radio Shack outlet. If your junk box contains a few old transistor radios and a twelve-volt power source, you shouldn't have to buy anything at all.

Before getting into the actual conversion steps, let's review what we have and where we're taking it. The circuit boards on the surplus market were destined to go into a whole family of Hy-Gain sets (models 2679, 2680, 2681, and 2683, at least). The receiver is a dual-conversion superhet with i-fs at 10.7 and .455 MHz. The transmitter is AM with an output between 3.5 and 6 Watts depending on individual transistor characteristics and the supply voltage. The heart of the frequency-determining scheme is a PLL-02A phase-locked loop chip, and it is possible to put the rig on ten meters by rearranging the wiring of the channel selector switch and modifying some of the other loop components. The theory behind the means of changing the frequency coverage is described in my earlier article ("CB to 10," *73 Magazine*, September, 1980) in more detail than I will go into here. I strongly suggest that you get and study that earlier article along with a circuit diagram of the board (I use the Sams Photofact folder covering the Hy-Gain model 2679A) before you start this project. The modifications aren't difficult, but I won't repeat here large sections of the earlier article. The modifications described here are given in three stages. First, the basic conversion to CW on ten meters: the frequency change, the bfo, fine tuning, and putting the transmitter on CW. Second are some convenience features: sidetone oscillator, detector modifications, rf/i-f gain control, transmitter frequency offset, and an active audio filter. The final stage is the modification to give full break-in. There are a lot of circuit changes involved in the complete conversion and I strongly suggest that you make and try them out one at a time. Troubleshooting a problem can be fairly easy when you know that it must be due to those last five wires you moved. A lot more time and test equipment will be needed if the set is silent and the cause could lurk in any of a half dozen modified areas. There are a lot of circuit changes involved in the complete conversion but most can be made and tested a few at a time.

A complete "road map" of the conversion is shown in Fig. 16 where a block diagram of the transceiver shows how the various steps fit into the big picture. For a starting point, it is assumed that your board is checked out and working as designed on 11 meters.

Several last precautions are in order before getting down to circuit details. Hy-Gain made a lot of these boards in many different varieties. Many have open areas on the circuit board which when filled with components add features like the i-f noise blanker. Don't worry too much about the missing components, but if you are given a choice, take the board with the most parts in it.

There are two different audio amplifier ICs in the sets I have seen: the pin-out and circuit are different, so you should watch out for that. Some boards were made to have the channel switch solder directly to the board, while others had posts for wire leads—this is a minor matter, but something you may have to allow for.

There is one crucial dif-

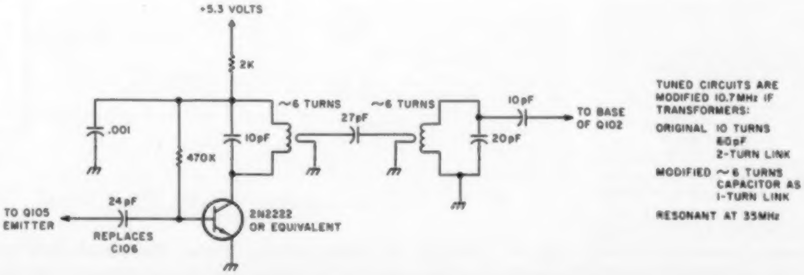
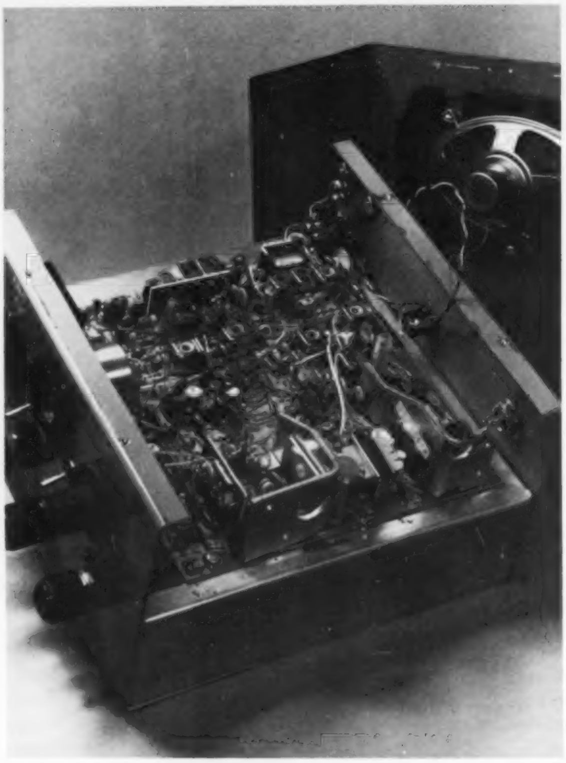

+5.3 VOLTS
2K
.001
470K
10pF
~6 TURNS
27pF
~6 TURNS
20pF
10pF
TO BASE OF Q102
TO Q105 EMITTER
24pF
REPLACES C106
2N2222 OR EQUIVALENT
TUNED CIRCUITS ARE MODIFIED 10.7MHz IF TRANSFORMERS:
ORIGINAL 10 TURNS 60pF 2-TURN LINK
MODIFIED ~6 TURNS CAPACITOR AS NOTED 1-TURN LINK
RESONANT AT 35MHz

Fig. 3. Tripler schematic diagram.



Interior view. Note the tripler board and the active filter board mounted upright from the main circuit board. Also shown is the method of mounting the speaker inside the top cover.

ference between the boards presently available—the PLL IC sometimes has 16 leads and sometimes has 18. The 16-pin packages may have one of several type numbers, but all are similar to the PLL-02A and can be converted as described in this (and the earlier) article. The 18-pin PLL IC is a dead end. These boards were destined to go in the Hy-Gain 16, a uP-controlled trunk mount model with a fancy calculator-like microphone/control unit. The PC card communicated with that unit via a serial data bus controlled in part by extra circuits inside the 18-pin PLL IC. Those boards cannot be converted as described here. If you have one of those boards, your best bet is to get the microphone and interface card that go with the main board and put it on 10 by changing the 11.806-MHz crystal.

Stage One—The Basic CW Conversion

The first and biggest step in modifying the rig is getting the operating frequency to ten meters. The conversion of the phase-locked loop requires three main steps: changing the programming of the loop divider, increasing the passband of the low-pass filter following the loop mixer, and adding a frequency tripler between the 11.806-MHz crystal oscillator and the loop mixer. Changing the loop frequency programming is the easiest step of the three. The PLL-02A chip contains a nine-stage binary divider which, along with the 10-kHz reference derived from the 10.240-MHz oscillator, sets the loop operating frequency. The divider is switched by changing the dc levels on pins 7 through 15. A logic one (5 volts) on a particular pin will enable the division controlled by that pin. All nine control pins are manipulated by the channel switch so that for channel 1 the overall division is 224 while on channel 40 the division is 268. The plan is to change this switch coding and therefore the operating frequency.

For example, note that since channel 1 is on 26.965 MHz and the steps are 10 kHz apart, we could move channel 1 to 28.005 MHz if we could change the divisor code to correspond to 328 on that channel instead of 224. Unfortunately, we can't make completely arbitrary changes in the divisor size because we are stuck with the channel switch and the code built into it. However, it is possible to reroute the connections between the switch and the PLL chip so that channel 1 moves up 960 kHz to 27.925 MHz. This means that channel 8 will then fall on 28.015 MHz and channel 40 on 28.365 MHz. The bulk of ten-meter CW activity takes place in the lower 200 kHz of the band, so the seven lower channels won't really be missed.

Now for the actual wiring changes. The schematic of the change is shown in Fig. 1. First cut apart pins 8, 9, and 10 of the IC on the circuit board foil. Pin 7 is disconnected from the channel switch and connected to +5 volts at pin 1, and the same is done for pin 9. Pin 8 is grounded and pin 10 is connected to the switch terminal that used to go to pin 7. That's all there is to the channel selector modification.

The frequencies for the new channels are given in Table 1 along with the appropriate phase-locked loop coding. The logic 1 level corresponds to 5 volts, while the 0 is ground, and you will want to run down the IC pins with a voltmeter to verify that the correct code for a particular channel actually shows up. There are several types of 40-channel switches sold for use with this board and it is easy to get confused about where the 5 volts goes in and the various IC pin connections come out.

Notice that the 10-meter channels, like the CB channels, are 10 kHz apart but that some frequencies are skipped and others are out of order. Be careful of the

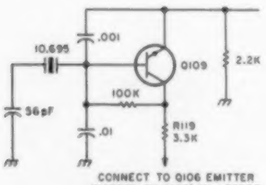


Fig. 4. The bfo, Q109, is supplied power constantly from Q106 instead of only during transmit.

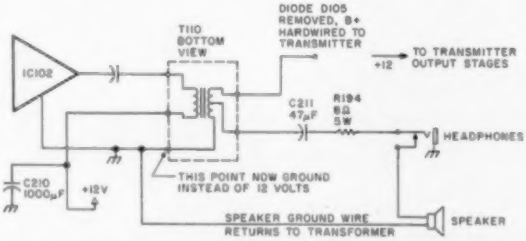


Fig. 5. Changes to audio output stage. The modulator is disabled by the removal of D105 and the speaker circuit is now operated at ground potential.

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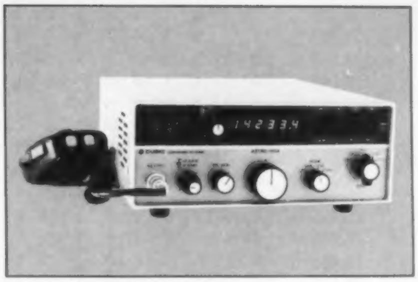

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band edges, particularly if you're a Novice and especially after the fine-tuning modification is added.

The next step is to change the passband of the low-pass filter between the loop mixer, Q102, and the mixer buffer, Q103. This modification is necessary because the highest frequency passing through this filter is now 3.64 MHz instead of 2.68 MHz. The circuit changes, shown in Fig. 2 are straightforward. C108 and C109 are reduced from 330 to 130 pF, about one-third of the turns are removed from L101, and the inductor is paralleled by a 24-pF capacitor. These changes are fairly non-critical; the set described in the earlier article used 180-pF capacitors, half the turns on L101, and 82 pF in parallel with the coil. The values shown in Fig. 2 work fine, but if you have some capacitors that are slightly larger, don't be afraid to try them.

The final and probably most complex change is the addition of the tripler following the 11.806-MHz oscillator. The mixer input is really looking for the third harmonic of that frequency, but the Hy-Gain designers were able to save a stage by letting the mixer do the frequency multiplication as well as the mixing function. That trick doesn't work as well for us because the loop operating frequencies are shifted enough that some of the spurious mixer products cause trouble. As explained in the previous article, these spurious products can actually prevent lock on frequencies higher in the ten-meter band. The CW end of the band is close enough to the CB frequencies that the loop will lock without the tripler addition, but I found that the fine-tuning modification (described later) would not function properly. The frequency would shift all right, but over a portion of the shift range an unwanted beat note would appear in the mixer output. This beat would cause FM on both the transmitted and received signals. The tripler completely cured the problem, but you may elect to first get the loop running without that added complication as an easy means of verifying the other PLL modifications. By all means do add the tripler before getting on the air, or be prepared to get a lot of reports of hum on your signal (and don't be fooled, as I was at first, by looking at your output envelope and seeing no modulation—it sounds like AM hum, but being FM won't show on a scope.

The tripler schematic shown in Fig. 3 is simpler than the one described in the first article, but works just as well. A single stage multiplies the 11.806-MHz signal and two lightly coupled tuned circuits select out the 35.4-MHz signal. The tuned circuits used in this version are 10.7-MHz i-f transformers modified by the removal of half the turns on the core and replacement of the 55-pF stock capacitors with 20-pF units. Some experimentation may be necessary to get the circuits resonant at 35 MHz, and a good grid-dip meter is an invaluable aid. There are other techniques which would work well. For example, if you're really well equipped, you could use a variable frequency signal source and a high bandwidth oscilloscope. Of course, you can use any other type of tuned circuit—whatever the junk box has as long as it fits into the space available.

As shown in the photographs, I built the circuit on a small scrap of printed circuit board and supported it by the stiff leads used to supply power and signals to the board. This isn't the most mechanically rugged technique, but it is neat and with careful placement of the support leads is strong enough to be reliable. I reinforced the wires where they entered the main circuit board with a small drop of epoxy cement so that the stress would not be on the thin circuit foil below the board.

		PLL Pin Levels								
Channel	Frequency	15	14	13	12	11	10	9	8	7
1	27.925	0	0	0	0	0	0	1	0	1
2	27.935	1	0	0	0	0	0	1	0	1
3	27.945	0	1	0	0	0	0	1	0	1
4	27.965	0	0	1	0	0	0	1	0	1
5	27.975	1	0	1	0	0	0	1	0	1
6	27.985	0	1	1	0	0	0	1	0	1
7	27.995	1	1	1	0	0	0	1	0	1
The above channels not in the 10-meter amateur band.										
8	28.015	1	0	0	1	0	0	1	0	1
9	28.025	0	1	0	1	0	0	1	0	1
10	28.035	1	1	0	1	0	0	1	0	1
11	28.045	0	0	1	1	0	0	1	0	1
12	28.065	0	1	1	1	0	0	1	0	1
13	28.075	1	1	1	1	0	0	1	0	1
14	28.085	0	0	0	0	1	0	1	0	1
15	28.095	1	0	0	0	1	0	1	0	1
16	28.115*	1	1	0	0	1	0	1	0	1
17	28.125*	0	0	1	0	1	0	1	0	1
18	28.135*	1	0	1	0	1	0	1	0	1
19	28.145*	0	1	1	0	1	0	1	0	1
20	28.165*	0	0	0	1	1	0	1	0	1
21	28.175*	1	0	0	1	1	0	1	0	1
22	28.185*	0	1	0	1	1	0	1	0	1
23	28.215	1	0	1	1	1	0	1	0	1
24	28.195*	1	1	0	1	1	0	1	0	1
25	28.205	0	0	1	1	1	0	1	0	1
26	28.225	0	1	1	1	1	0	1	0	1
27	28.235	1	1	1	1	1	0	1	0	1
28	28.245	0	0	0	0	0	1	1	0	1
29	28.255	1	0	0	0	0	1	1	0	1
30	28.265	0	1	0	0	0	1	1	0	1
31	28.275	1	1	0	0	0	1	1	0	1
32	28.285	0	0	1	0	0	1	1	0	1
33	28.295	1	0	1	0	0	1	1	0	1
34	28.305	0	1	1	0	0	1	1	0	1
35	28.315	1	1	1	0	0	1	1	0	1
36	28.325	0	0	0	1	0	1	1	0	1
37	28.335	1	0	0	1	0	1	1	0	1
38	28.345	0	1	0	1	0	1	1	0	1
39	28.355	1	1	0	1	0	1	1	0	1
40	28.365	0	0	1	1	0	1	1	0	1

*These frequencies are in the Novice segment.

All frequencies given are nominal and may vary ±5 kHz or so if you include the fine-tuning modification.

Table 1. New channel frequencies and PLL coding.

Once these circuit modifications are made, the loop can be adjusted for proper operation. Monitor the dc voltage on the positive side of C115 and adjust the vco slug (T101) so that the voltage varies from a low of around a volt on channel 1 to a high of about two volts on channel 40. The voltage should change slightly each time the channel switch is advanced. This voltage is a measure of the driving force necessary to pull the vco from its free-running frequency (set by T101) to the frequency requested by the channel selector; in fact, a meter inserted at this point could be calibrated to

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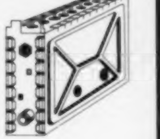

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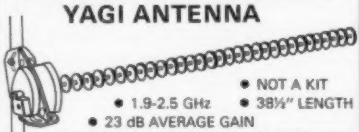

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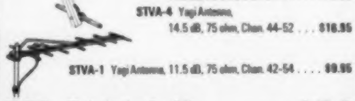

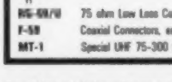

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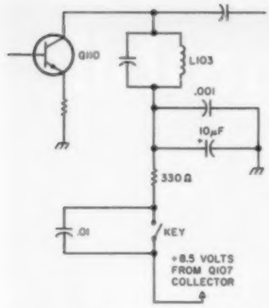
Q110
L103
.001
10µF
330Ω
.01
KEY
+8.5 VOLTS FROM Q107 COLLECTOR

Fig. 6. Circuit modification to allow transmitter keying at the transmitter mixer, Q110.

read the ten-meter operating frequency.

Knowing this, you can easily determine if the phase-locked loop is running normally. If, for example, you can switch channels without changing the voltage at C115, then the vco frequency hasn't moved as it should and something is wrong. If the voltage seems to hop around in great leaps as you rotate the channel selector, then the channel switch is probably wired up to the PLL incorrectly.

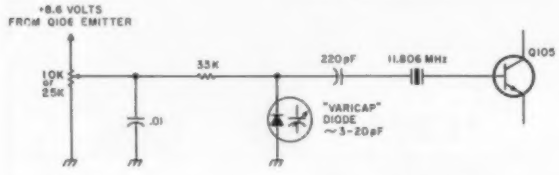
+8.6 VOLTS FROM Q106 EMITTER
10K or 25K
.01
33K
220pF
11.806 MHz
Q105
"VARICAP" DIODE ~3-20pF

Fig. 7. Fine tuning with a varicap diode.

Another good means of testing for proper operation is to listen to the output of the loop mixer with a receiver. Remember that on channel 1 the loop divider is set to 320 and that on channel 40 it is set to 364. That means that the output of the mixer buffer, Q103, will be at 3.200 MHz on channel 1 and 3.640 MHz on channel 40. Accordingly, when the channel is set to 36, the output of Q103 should be on 3.600 MHz, and that can be easily verified by connecting one end of a length of wire to the antenna terminal of an 80-meter receiver and wrapping the other end (insulated, with no direct electrical connection) around Q103. You can figure out which channel position corresponds to 36 by counting backwards from channel 40; that channel you can find by watching for the large voltage change across C115 as the loop jumps from channel 40 to channel 1.

As an aside, it's interesting to note that the rig can now be used as a crystal-controlled calibrator which can be walked in precise 10-kHz steps across the bottom portion of 80 meters. The 3.600-MHz output on channel 36 can be zero beat with your crystal calibrator by adjusting the 10.240-MHz oscillator; then the PLL signals will be just as accurate on any of its channels as your calibrator is at 3.6 MHz.

With the PLL modifications complete and operating, the set should operate as an AM rig (into a dummy only!) from 27.925 to 28.365 MHz. By peaking up the receiver front end (T104 and T105) and connecting an antenna, you should be able to hear some CW signals, though without a bfo you won't be able to copy them. The transmitter can be peaked into a dummy load by adjusting L103, L102, T102, T103, L106, L109, and L110. You'll find that the first three adjustments mentioned are the sharpest tuning ones. I would suggest peaking everything up on 28.115 MHz (channel 16) since most of your operation will be within 100 kHz of that frequency.

The remaining steps in the basic CW conversion are the bfo addition, the AM to CW transmitter change, and the provision for fine tuning. These steps were covered in detail in the first article so will only be mentioned briefly here. The bfo is actually the 10.695-MHz transmit carrier oscillator, Q109, which can be turned on during receive by connecting the supply end of the 3.3k emitter resistor (R119) so that it gets 8.5 volts all the time in-

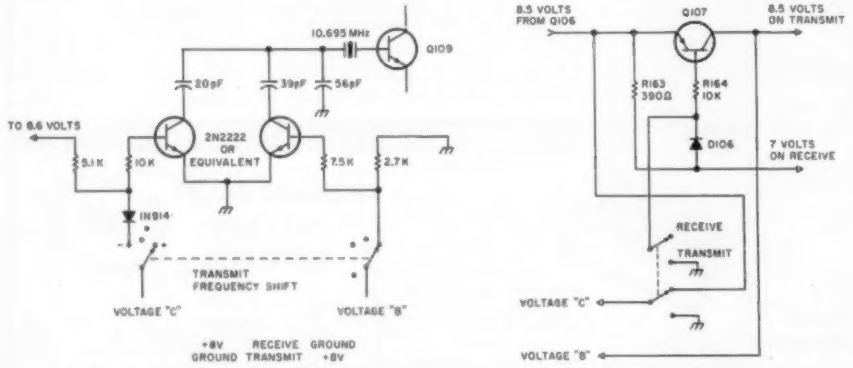
10.695 MHz
Q109
20pF
39pF
56pF
TO 8.6 VOLTS
5.1K
10K
2N2222 OR EQUIVALENT
7.5K
2.7K
IN914
TRANSMIT FREQUENCY SHIFT
VOLTAGE "C"
VOLTAGE "B"
+8V RECEIVE GROUND
GROUND TRANSMIT +8V
8.5 VOLTS FROM Q106
Q107
8.5 VOLTS ON TRANSMIT
R163 390Ω
R164 10K
D106
7 VOLTS ON RECEIVE
RECEIVE
TRANSMIT
VOLTAGE "C"
VOLTAGE "B"

Fig. 8. (a) Circuit to provide a selectable frequency offset during transmit. (b) Circuit for manual T/R switching.

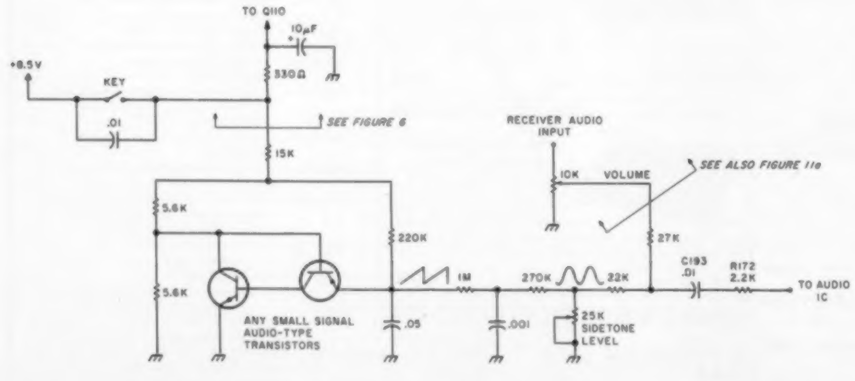
TO Q110
10µF
330Ω
+8.5V
KEY
.01
SEE FIGURE 6
15K
RECEIVER AUDIO INPUT
10K
VOLUME
SEE ALSO FIGURE 11a
5.6K
5.6K
220K
27K
ANY SMALL SIGNAL AUDIO-TYPE TRANSISTORS
.05
1M
270K
22K
.001
25K SIDETONE LEVEL
C193 .01
R172 2.2K
TO AUDIO IC

Fig. 9. Sidetone oscillator circuit.

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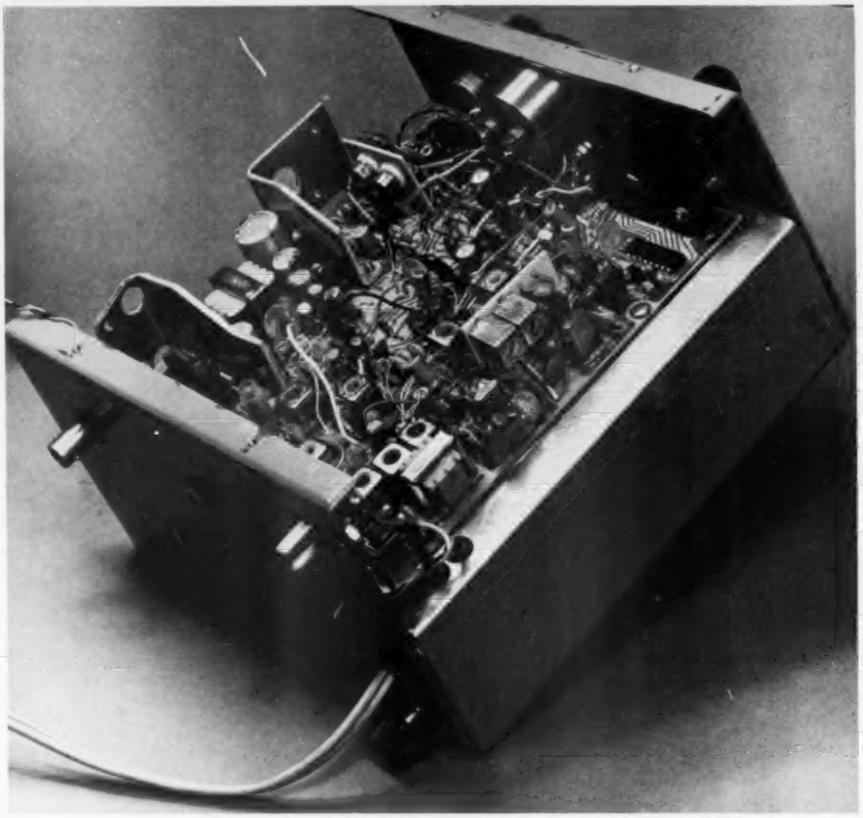
stead of only when the rig is transmitting. The emitter of Q106 (the 8.5-volt voltage regulator) is a convenient source for this voltage. The circuit change is shown in Fig. 4.

Putting the transmitter on CW is almost as simple. First the modulator output is disconnected from the transmitter driver and final amplifier by the removal of diode D105 (located just behind the audio transformer). The transmitter stages are then powered by wiring the 12-volt line directly to what used to be the cathode end of the diode. The final and driver are class C amplifiers so they won't draw any current until driven and there is no need to switch this power line. It is prudent to keep a load on the audio power stage at all times, but at this point there is no load during transmit because the modulator function is disconnected. The microphone push-to-talk switch normally opens the speaker circuit during transmit and that should be rewired so that the lower end of the speaker is connected to ground at all times. The output transformer is also rewired so that the speaker circuit does not operate with a 12-volt bias. This step helps reduce speaker thumps caused by the 12-volt supply dropping when the transmitter is keyed. These modifications to the transmitter are shown in Fig. 5.

Finally, some provision must be made for keying the transmitter, and that is done by keying the B+ line feeding the transmit mixer as shown in Fig. 6. The RC filter added in series with the power lead softens the rise and fall times enough to give brisk but clickless keying.



Back inside view. Note rear panel BNC for rf, miniature jack for external speaker DPST switch and male jack for external dc supply, and ac fuse for internal supply.

The fine-tuning modification is shown in Fig. 7. The 11.806-MHz heterodyne oscillator is tuned over about a 4-kHz range with a varicap diode, thus giving after frequency multiplication a 12-kHz shift in operating frequency. If your junk box doesn't have any varicap diodes, you could substitute a 35-to-55-pF trimmer capacitor, but the diode is a neater method. Not all tuning diodes are the same and you may have to try several or put several in parallel in order to get the required frequency change. Notice that as the oscillator is moved around in frequency, the phase-locked loop will force the vco to move in step so that the output signal of the loop mixer (Q103) will not change in frequency.

At this stage of development the rig is ready to go on the air. Keep in mind that the zero-beat frequency is the transmit frequency and people will have a tendency to move in that direction. Once you realize that is happening, you can ask the other fellow to stay a kHz offset from your transmitting frequency, or you can simply move the fine-tuning knob a bit when you start to receive. That's a nuisance, but not really a big problem when you get used to it.

Stage Two—Some Convenience Features

There are a lot of features which can be added to the basic transceiver to increase operating convenience. The most appreciated will probably be a means of automatically offsetting the transmitter's frequency from the receiver's and the sidetone oscillator. The receiver performance can be increased considerably by removing the agc circuitry, which is now responding to the bfo instead of the other station anyway, and controlling the rf and i-f gains from a front-panel potentiometer. There are some changes which can be made to increase the sensitivity of the detector—mainly the removal of the noise limiter. Last but not least is the addition of an active audio filter to give the receiver some much needed selectivity.

The way to offset the carrier oscillator is shown in Fig. 8. If you examine the printed circuit foil closely, you'll find that this same technique was destined to be used on the 10.24-MHz oscillator as a receiver offset option. Somehow it seems more natural to move the transmitted frequency without affecting the receiver. Depending on the characteristics of in-

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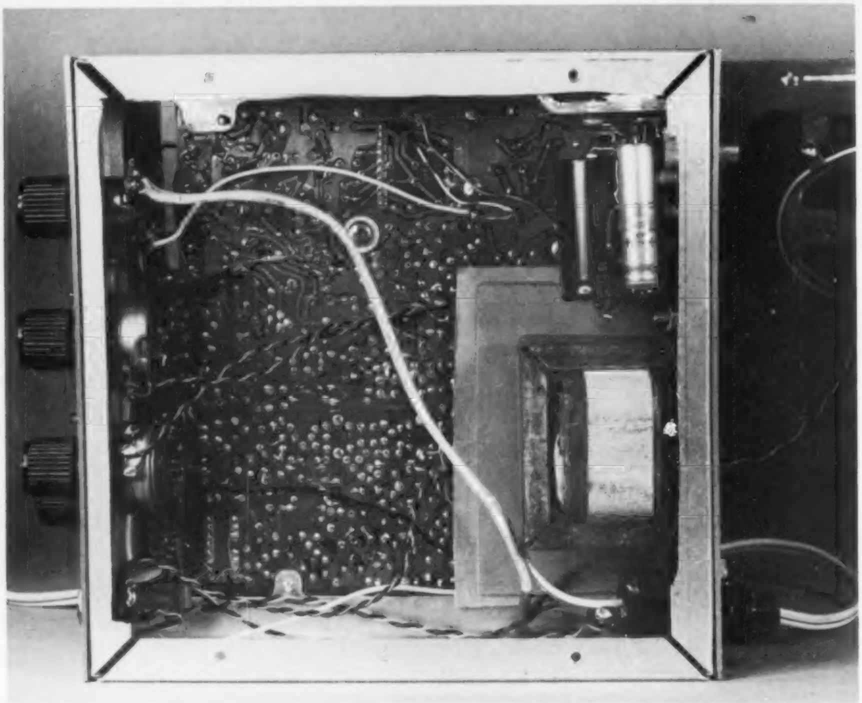


Bottom view. Power supply module in place. Rectangular object behind the transformer is the magnetic shield described in the text. Power supply connecting wires are left long enough to allow the module to be moved for circuit board servicing. Note that the cut-out portion of the chassis top allows for dc isolation of the PC board ground.

dividual crystals, there may be some changes required in the sizes of the 56, 39, and 20-pF capacitors. Those values with my crystal gave a ±700-Hz offset. The circuit shown is designed to be mated with voltages available from the break-in sequencing circuits described later. If you are going to use a mechanical switch for the transmit-receive changeover, then the circuit of Fig. 8(b) is an easy means of getting the two controlling voltages.

The circuit for the sidetone oscillator is shown in Fig. 9. There is nothing special about this circuit, but it does use few parts and draws only about .3 mA of current. The tone can be adjusted by changing the size of the 220k resistor if desired. The oscillator generates a sawtooth which is a bit harsh-sounding, so a low-pass filter comprised of a 1 meg resistor, the .001-uF capacitor, and the 270k resistor is used to smooth out the waveform. There is nothing critical about any of these components or the transistors used and value changes of as much as 30% will probably go unnoticed.

Several changes were made to the detector circuitry to make it more suitable for CW use. The "before" and "after" schematics are shown in Fig. 10. Two changes are clearly needed: The S-meter and agc are removed because they now respond to the bfo signal instead of incoming Morse signals. This was particularly troublesome since the agc insisted on keeping the receiver gain low, and so the first change is to control the agc line with a front-panel 25k pot. (I had hoped that this control wouldn't be necessary and that the receiver could be set for maximum gain, but it turns out that strong signals on nearby frequencies, i.e., local CBers and worse, can cross-modulate the front end and show up in the audio output. This is probably due to using the 10.695-MHz bfo as much as poor front-end design. In the future, I want to try adding a proper 455-kHz bfo, but for now I can significantly reduce the problem by using the i-f gain control and switching when necessary to a horizontal dipole. Most CB operation is with vertical antennas, so the local operators are attenuated by 3 or 4 S-units when a horizontal antenna is used.)

Also removed from the detector circuit is the noise

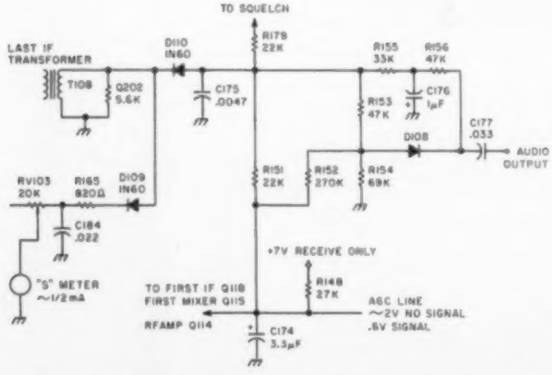

TO SQUELCH
LAST IF TRANSFORMER
T108
Q202 5.6K
D110 IN60
C175 .0047
R179 22K
R155 33K
R156 47K
R153 47K
C176 1μF
C177 .033
D108
AUDIO OUTPUT
R151 22K
R152 270K
R154 69K
RV103 20K
R165 820Ω
D109 IN60
C184 .022
"S" METER ~1/2 mA
+7V RECEIVE ONLY
R148 27K
TO FIRST IF Q118 FIRST MIXER Q115
RFAMP Q114
AGC LINE ~2V NO SIGNAL .6V SIGNAL
C174 3.3μF

Fig. 10(a). Detector circuit before modification.

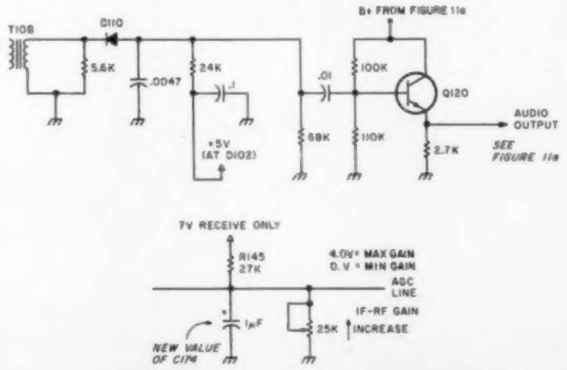

T108
D110
5.6K
.0047
24K
.1
+5V (AT D102)
68K
.01
B+ FROM FIGURE 11a
100K
110K
Q120
AUDIO OUTPUT
2.7K
SEE FIGURE 11a
7V RECEIVE ONLY
R145 27K
4.0V= MAX GAIN
0. V = MIN GAIN
AGC LINE
IF-RF GAIN
1μF
25K
INCREASE
NEW VALUE OF C174

Fig. 10(b). Detector circuit after modification.

limiter consisting of R155, R156, C176, and D108. These components are in a rather clever arrangement which clips both low-level fuzz and high-level spikes. Interestingly, the circuit on the board is always wired up and operating and it was only the models which had the provision for turning the circuit off (by putting a switch in place of the jumper J106) that advertised the feature!

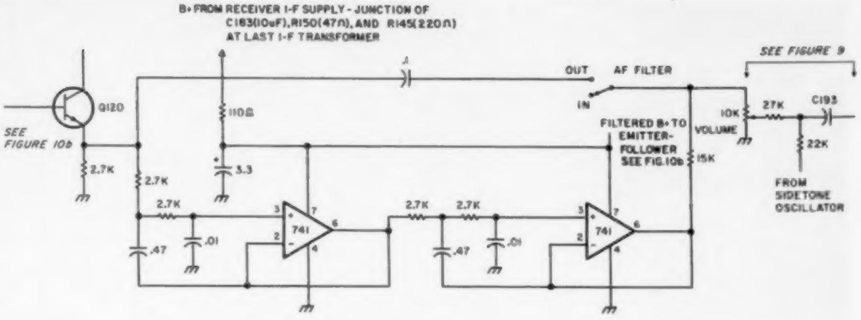

B+ FROM RECEIVER I-F SUPPLY - JUNCTION OF C183(10uF),R150(47Ω), AND R145(220Ω) AT LAST I-F TRANSFORMER
Q120
SEE FIGURE 10b
2.7K
2.7K
110Ω
3.3
2.7K
.47
.01
741
3
2
7
6
4
J
2.7K
2.7K
.47
.01
741
OUT
AF FILTER
IN
FILTERED B+ TO EMITTER-FOLLOWER SEE FIG.10b
15K
10K
VOLUME
SEE FIGURE 9
27K
C193
22K
FROM SIDETONE OSCILLATOR

Fig. 11(a). Circuit diagram for active filter.

The squelch is also removed, but the squelch transistor, Q120, is rewired as an emitter-follower buffering the audio output signal. There are two reasons for this addition. It was found in the breadboard stage that the original volume control setup, a 50k pot from C177 to ground, was susceptible to picking up hum as I probed around the circuit board with a finger. The use of an emitter-follower makes it possible to have all of the wires leaving the board be low-impedance lines, while at the same time the high-impedance portions of the circuit are kept physically small, which means that hum is much less of a problem. The emitter-follower is also a good interface between the detector and the active audio filter. As can be seen in Figs. 11(a) and 10(b), the same B+ decoupling circuit is used to power the active filter and emitter-follower. There is a lot of audio gain after these circuits and a well-filtered voltage source is a must to prevent audio oscillations.

The audio filter design is straight from *Solid State Design for the Radio Amateur* (an ARRL publication). A peaked low-pass characteristic was chosen because of its high attenuation above the cutoff frequency. Two sections are used, each with a Q near 5 and a cutoff frequency of about 800 Hz; the overall frequency response is shown in Fig. 11(b). The two op amps are operated between ground and the 12-volt supply, with the input signal being biased at 6 volts by the emitter-follower. This arrangement saves the several resistors which would otherwise be necessary to derive the bias voltage. The output of the filter is fed to the volume control through a 15k resistor, thus providing some attenuation to compensate for the peaking above unity gain which occurs at the cutoff frequency.

The 15k value was chosen so that the speaker level of an 800-Hz tone is approximately the same either with or without the filter being used. The resistor also serves the purpose of providing a high-output impedance for the filter—when the filter is switched "out," what actually happens is that the low-impedance output of the emitter-follower attenuates the filter output into insignificance. The audio from the volume control is fed into the IC audio amplifier as indicated in Figs. 9 and 11. The filter is quite a help when the band gets crowded, often making otherwise impossible contacts easy copy. With the filter switched out, it is easy to quickly scan the band using only the channel switch since even signals several kHz from bfo zero beat can then be copied.

The rf voltmeter shown in the photographs was introduced simply by inserting parts into the proper holes on the circuit board. This was another feature not wired until the last stages of manufacture. The only departure I made from the Hy-Gain layout is the replacement of the variable resistor (Rv104) on the circuit board) with a fixed 15k unit. That gives about half scale on my meter, a .5-mA unit, with five Watts of output. You can change this as necessary to fit the meter you choose. The circuit, shown in Fig. 12, has a 10-uF capacitor to filter the rectified waveshape so that the pointer won't slam back and forth with keying.

Stage Three—Full Break-in

Full break-in CW operation is something that few newer hams have experienced, principally because many amateur transceivers are designed with sideband in mind and CW added as a "tack-on." With full break-in it is possible to hear the other fellow sending whenever your key is up, even in the middle of a letter. When the stations at both ends of a QSO have break-in capability, the conversation is very much more natural than the usual segmented contact. Break-in is also a good operating feature: It's much easier to make and continue QSOs under difficult conditions when you can hear what's going on during your transmission.

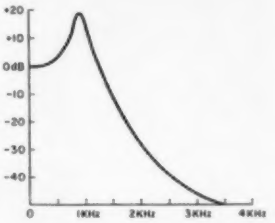


Fig. 11(b). Measured performance of filter.

The big problem with getting a transceiver to operate full break-in successfully is the elimination of clicks and thumps in the receiver as the rig is switched rapidly between transmitting and receiving. Many things must occur in an ordered sequence as the rig is keyed. When the key is closed, the receiver must be biased off—the rf amplifier must be disabled, the agc turned down, perhaps an i-f stage muted as well. Any frequency offset in the vfo must be done before the

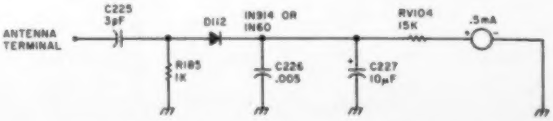
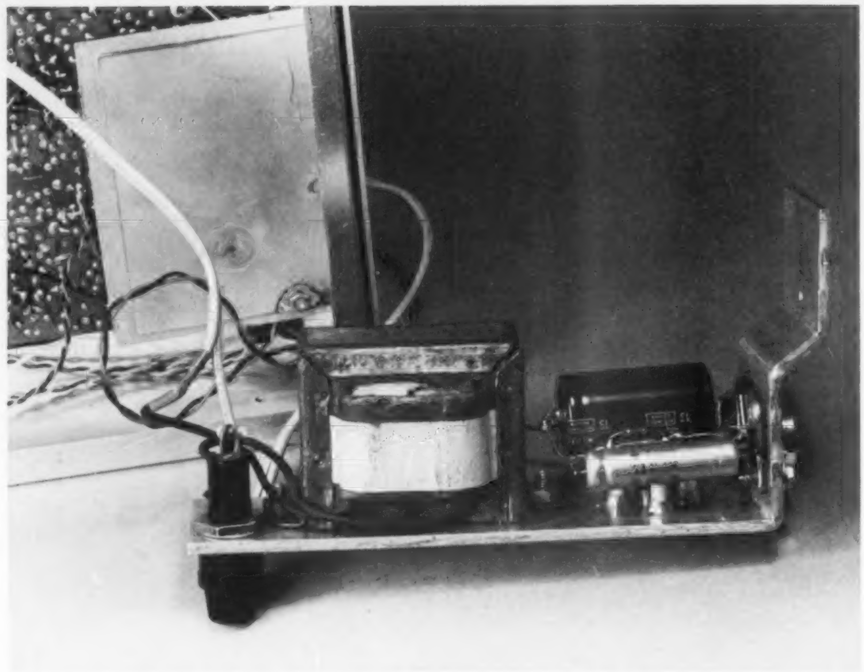


Fig. 12. Rf voltmeter added by putting parts into the appropriate positions on the PC board.



The power supply module removed from the main chassis to show construction. The aluminum bracket is 1/8" thick and transfers the power dissipated from the IC regulator into the main chassis.

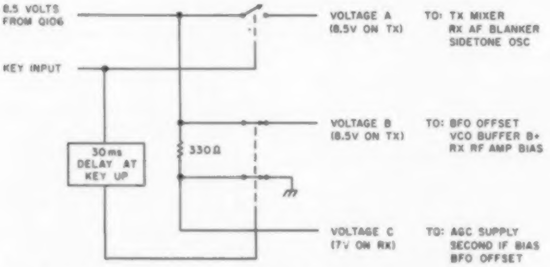

8.5 VOLTS FROM Q106
KEY INPUT
30 ms DELAY AT KEY UP
330Ω
VOLTAGE A (8.5V ON TX)
TO: TX MIXER
RX AF BLANKER
SIDETONE OSC
VOLTAGE B (8.5V ON TX)
TO: BFO OFFSET
VCO BUFFER B+
RX RF AMP BIAS
VOLTAGE C (7V ON RX)
TO: AGC SUPPLY
SECOND IF BIAS
BFO OFFSET

Fig. 13(a). Block diagram of break-in timing system shown in receive mode. Note that voltage C is inverse of voltage B.

transmitter comes on, and some sidetone must be inserted into the audio amplifier. The rf envelope must come up smoothly to avoid over-the-air clicks. When the key is raised, nothing should happen until the rf output has smoothly died away; then the vfo shift must be reinstituted and the receiver reactivated. Most importantly, all of these big shifts in operating condition should occur rapidly, yet without causing undue disturbances in the output audio. Ideally, the operator listening to the receiver would hear his own keying just as if it were coming from another station over the air. A very good break-in system is difficult to come by, and the circuits worked out for this application, while not providing perfect break-in, certainly provide acceptable performance.

The heart of the break-in circuitry, shown in Fig. 13, requires the addition of three transistors labeled Q1, Q2, and Q3. When the key is closed (keying current is 7 mA, which should be compatible with any keyer), Q107 is turned on directly and its output turns on the transmitter and turns off the receiver audio with a circuit which will be described shortly. The grounded keying terminal also provides a rapid discharge path for the 4.7-uF capacitor. Notice that while this capacitor can discharge through the signal diode, it must recharge more slowly through a 10k resistor. That inequality will provide a 30-ms recovery delay to keep the receiver off until the transmitter output has decayed completely away. The voltage across the 4.7-uF capacitor drives the base of Q1, and the emitter of that transistor is biased at about 2.4 volts by a forward-biased diode and an LED (which serves double duty as a front-panel power indicator). As the voltage at the base of Q1 rises and falls past 3 volts or so, the transistor turns on and off, switching in turn Q2 and Q3. The timing waveforms are shown in Fig. 13(c), with the exception of voltage B, which does pretty much the opposite of voltage C. The important fact to note is that while all three of these controlling voltages switch

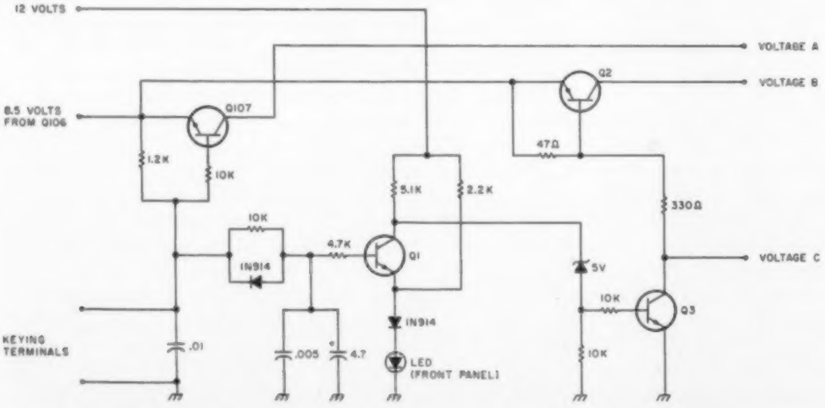

12 VOLTS
8.5 VOLTS FROM Q106
Q107
1.2K
10K
10K
1N914
4.7K
Q1
5.1K
2.2K
1N914
LED (FRONT PANEL)
KEYING TERMINALS
.01
.005
4.7
Q2
47Ω
330Ω
5V
10K
10K
Q3
VOLTAGE A
VOLTAGE B
VOLTAGE C

Fig. 13(b). Schematic diagram of break-in timing system. The transistors are general-purpose low power types.

simultaneously at key-down, only the collector voltage of Q107 switches immediately at key-up. As shown in Fig. 13(c), the 30-ms delay gives plenty of time for the transmitter to get off the air before the receiver is turned back on. Also indicated in Fig. 13(b) and Fig. 16 is where the three controlling voltages go in the rig as a whole.

The sequencing circuits just described give plenty of receiver protection during keying, but unfortunately they are not thumpless. Some additional quieting was achieved with the addition of the simple audio blanker shown in Fig. 14. I've used this system for several months and find its performance quite acceptable. Being a bit of a perfectionist, however, I have looked into the reasons for the remaining thumps. The complete cure would seem to require a soft exponential transition of perhaps 10-ms time constant on all of the keying waveforms controlling the receiver. The rf amplifier bias, second i-f bias, and agc line inputs are relatively easy to filter by the addition of the proper capacitors, but vco buffer B+ must be powered from a low-impedance source during transmit and so would require either the addition of another transistor or a change in the timing circuits to ensure that the receiver is off when buffer B+ is stepped up or down. Turning the receiver off exponentially may require a different sequencing circuit in any case to delay the transmitter turn-on. The system described in Fig. 13 works fine, but if you enjoy experimenting, you might look into some variations.

One last hint on reducing keying noise: Be sure to return the speaker ground wire to the circuit board as closely as possible to the ground pin of the audio IC.

This will be pin 2 if the IC is a BA521 or pin 9 if it is a TA7205. Otherwise, the heavy transmitter keying current (around 1 Amp) can couple into the speaker wiring and cause a click that is not muted by the receiver gain control.

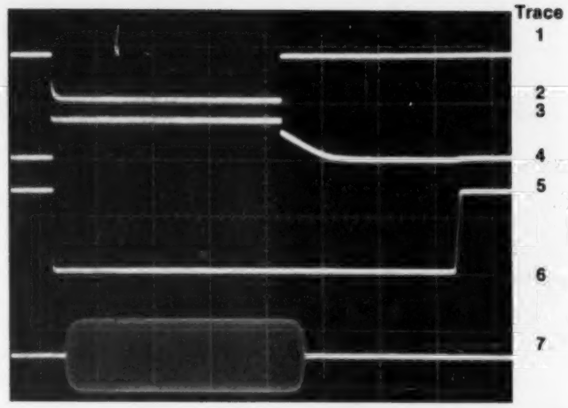


Fig. 13(c). Timing waveforms. Horizontal scale is 10 ms per division; character shown is one dot at 30-wpm rate. Trace 1 is key-up position; 2 is key down; 3 is +8 volts and 4 is ground (voltage A, Q107 collector); 5 is +8 volts and 6 is ground (voltage C, Q3 collector); 7 is rf envelope output, 50 volts/div., 62-Ohm dummy load.

Odds and Ends—Power Supply, Cabinet, Future Work

All in all, this makes a very nice little CW rig. The only reason it might be classified as a toy is that it is so inexpensive to get on the air. If your junk box contained several old transistor radios, the total cash outlay for the project to this point should be something less than $20. I built the rig to this level and used it for about a month before deciding on a cabinet. The construction for the final enclosure is pretty well explained by the photographs. The board was mounted into the top surface of a 7″ × 7″ × 2″ chassis, front, back, and bottom plates were added, and a U-shaped cover was fabricated to form the top and sides. A 2½″ × 4″ oval speaker rescued from a junk TV set was mounted behind a grid of holes drilled in the top of the U. The holes were drilled using a piece of scrap perfboard as a guide—that made it easy to get such a nice even array. A piece of thin black cloth contact-cemented over the holes from the rear (after painting the box) protects the speaker from dust and dirt. The U-shaped piece happens to be a section cut from a large steel chassis bottom plate so I was able to solder nuts to the underside as anchors for the speaker mounting clamps.

It is certainly a convenience to have a built-in ac-operated power supply, and with any number of excellent IC regulators available for a couple of dollars, it seemed a shame to tie up a bench supply. The power supply shown in the photographs was built around a transformer and regulator found in my junk box. The circuit suggested in Fig. 15 will fit in the same space and shouldn't cost more than $15 if you buy all new parts.

As can be seen in the photographs, the power supply is built as a separate module. The aluminium bracket is fashioned from part of an old 1/8″ thick rack panel and fits up against the insides of the main chassis which then serves as a heat sink. To provide for portable opera-

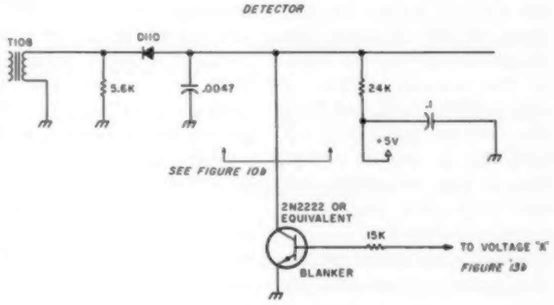


Fig. 14. Audio blanker circuit.

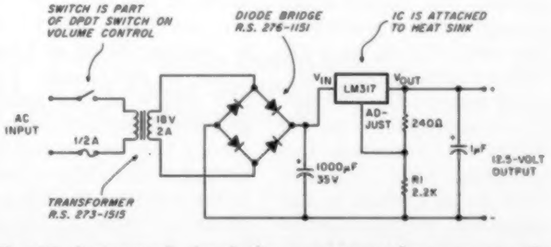
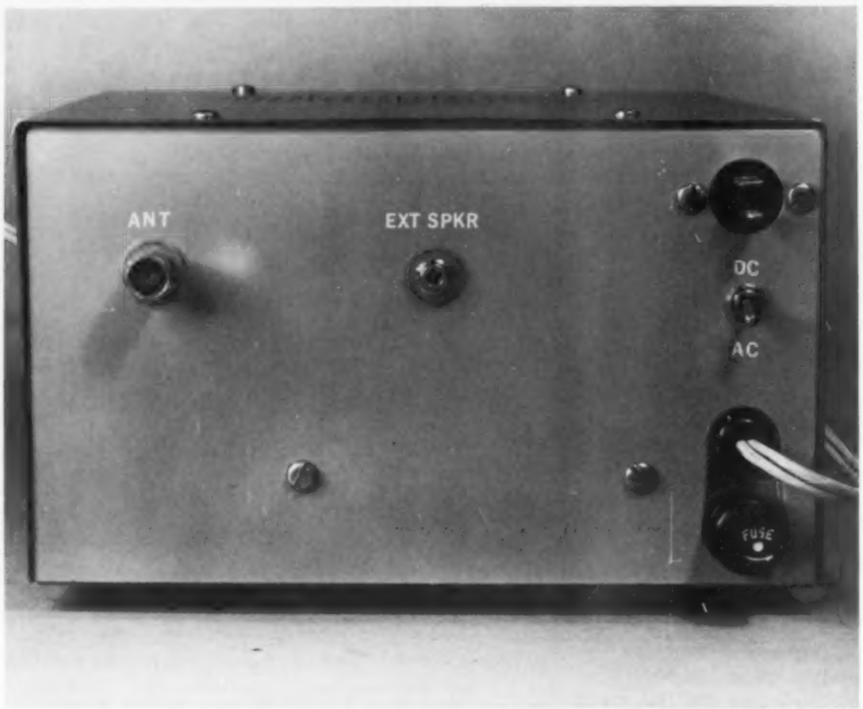

SWITCH IS PART OF DPDT SWITCH ON VOLUME CONTROL
DIODE BRIDGE R.S. 276-1151
IC IS ATTACHED TO HEAT SINK
AC INPUT
1/2 A
18V 2A
TRANSFORMER R.S. 273-1515
V IN
LM317
V OUT
ADJUST
240Ω
1000µF 35V
R1 2.2K
1µF
12.5-VOLT OUTPUT

Fig. 15. Suggested circuit for ac-operated power supply. Output voltage should be no lower than 12 to 12.5 volts at 1.5 Amps of load current. Output voltage may be adjusted by making small changes in R1.



The rear panel. The antenna shield is ac coupled to the circuit board ground. Note the isolating washer around the external speaker jack.

tion with an external 12-volt battery, a DPDT switch and male jack are mounted on the rear of the set to select the desired power source. Note in Fig. 16 that the power switch on the back of the volume control is also a DPDT unit and that this allows switching of both the ac and dc power lines so that the switch will work with either internal or external supplies.

What is not clear in the photographs or schematics is that the entire enclosure is isolated by capacitors from the circuit board's dc ground. This feature could prevent some fireworks if you used the rig in a car with a positive ground electrical system! The dc isolation is provided for on the board by separate foil mounting pads, but you have to be careful to use isolating washers when mounting the key and headphone jacks.

While on the subject of power supplies, a word or two about dc supply voltage is in order. The transmitter rf output will vary from set to set because of transistor differences, but it will always go up with increased supply voltage. With my transmitter, 11 volts gives 3 Watts, 12 volts gives 4 Watts, 14 volts gives 5 Watts, and 15 volts gives 5.5 Watts of transmitter output. My power supply is set to deliver 12.7 volts on receive and this falls to 12 volts on transmit because of the 1.5-Amp current drain. Going to a 15-volt supply would provide an extra Watt and a half of output, but that is only 1.4 dB or less than ¼ of an S-unit worth of signal gain. You will notice in the photographs that the output transistor's heat sink is not attached to the cabinet wall as intended for the CB application. With a 12-volt supply, the final stage input is about 11 Watts, and with 4 Watts of output power, that leaves 7 Watts of heat to be dissipated by the heat sink. After a long transmission, the heat sink gets warm to the touch though not uncomfortably so. Higher input power would probably require that some attention be paid to this heat sink as well as the power supply. All in all, it doesn't seem worth the trouble for less than ¼ of an S-unit.

Whenever a power transformer is mounted in close proximity to sensitive circuits, the possibility exists of magnetically coupling 60-Hz hum into the signal path. For this reason, the transformer was mounted as far as possible from the audio section of the printed circuit board. Despite this precaution, there was a noticeable amount of hum modulating the received signals whenever the internal supply was used. This problem was completely cured by shielding the circuit board from the transformer with a 2½" × 3½" plate of sheet steel. As can be seen in the under-chassis photograph, this shield is mounted directly between the power transformer and the circuit board with a slightly larger rectangle of thin cardboard between the shield and circuitry to prevent shorting the PC runs together. The longer wire ends protruding below the PC card were also trimmed with a pair of side cutters to keep them from wearing their way through the cardboard. The shield is held in place by a nut soldered to one corner which is engaged by one of the screws holding the circuit board to the chassis.

The conversion steps described in this article are mostly simple circuit changes, but they often require the addition of several parts to the modified circuit. If you haven't worked much with printed circuit boards, you may wonder how additional parts can be added to an existing foil pattern. Actually, there are several ways to accomplish that feat.

First, there are lots of unused foil islands on this board. Most of these were supposed to be used in the addition of optional features and so are available to use when making circuit additions.

Next, there is a lot that can be done to add parts by modifying existing foil runs. Often in changing a circuit a long foil run is freed up when the component or circuit at one end is no longer needed. A sharp knife can be used to cut and remove a short section to open the circuit, and then the remainder of the run can be sectioned into several other islands. To make connection to these islands, a small hole can be drilled next to the foil (runs are so narrow that drilling a hole through them can ruin them) and the paint scraped off the copper to permit soldering.

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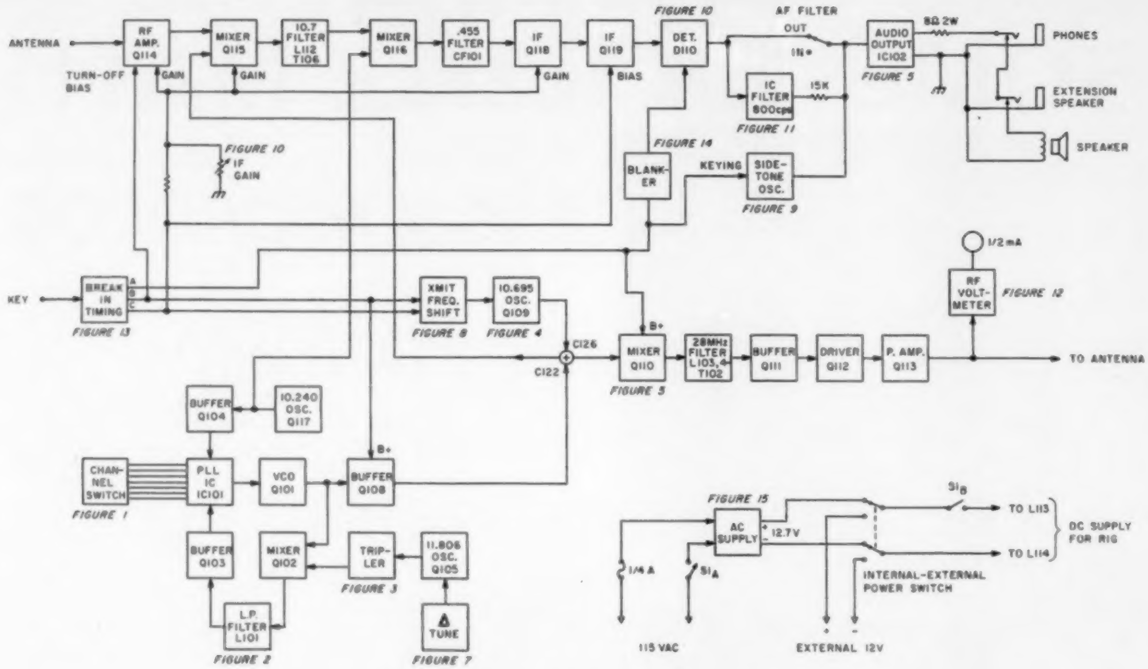
ANTENNA
RF AMP. Q114
TURN-OFF BIAS
GAIN
MIXER Q115
GAIN
10.7 FILTER L112 T106
MIXER Q116
.455 FILTER CF101
IF Q118
GAIN
IF Q119
BIAS
FIGURE 10
DET. D110
AF FILTER
OUT
IN
IC FILTER 800cps
15K
FIGURE 11
AUDIO OUTPUT IC102
FIGURE 5
8Ω 2W
PHONES
EXTENSION SPEAKER
SPEAKER
FIGURE 10
IF GAIN
FIGURE 14
BLANKER
KEYING
SIDE-TONE OSC.
FIGURE 9
1/2 mA
RF VOLT-METER
FIGURE 12
KEY
BREAK IN TIMING
A
B
C
FIGURE 13
XMIT FREQ. SHIFT
FIGURE 8
10.695 OSC. Q109
FIGURE 4
C126
C122
B+
MIXER Q110
FIGURE 5
28MHz FILTER L103,4 T102
BUFFER Q111
DRIVER Q112
P. AMP. Q113
TO ANTENNA
BUFFER Q104
10.240 OSC. Q117
CHANNEL SWITCH
FIGURE 1
PLL IC IC101
VCO Q101
B+
BUFFER Q108
BUFFER Q103
MIXER Q102
TRIPLER
FIGURE 3
11.806 OSC. Q105
L.P. FILTER L101
FIGURE 2
Δ TUNE
FIGURE 7
FIGURE 15
AC SUPPLY
12.7V
S1B
TO L113
TO L114
DC SUPPLY FOR RIG
1/4 A
S1A
INTERNAL-EXTERNAL POWER SWITCH
115 VAC
EXTERNAL 12V

Fig. 16. Block diagram of the converted transceiver.

Be sure to leave the section of copper long enough that the whole strip won't come unglued when you solder to it. Remember that for modification purposes the primary need is for component support since the actual circuit connections can be made with small insulated jumpers. To provide adequate support, it is not necessary that each of a component's leads be anchored to the foil. It is quite acceptable, for example, to have a small resistor standing upright with only one end actually soldered to the board and the top end connected elsewhere with a jumper.

It is also possible to make connections by soldering new leads to other wires where they come out on the top of the circuit board, though this technique is less desirable because it can mean that to disconnect one component may require unsoldering several.

The principal thing to remember when you're looking for a way to add a component is that you're modifying the board, not manufacturing it. Amateurs often unconsciously accept the manufacturer's techniques as ideal standards when actually the manufacturer laid out the board the way it is only so that it could be built efficiently and reliably by the people and machines on his production line. The techniques suggested here, while certainly not as efficient in construction time, can be just as reliable as the manufacturer's if they are applied neatly and carefully. Take the time to make good neat solder joints. If a part seems loose on top of the board or a component wire has to support a heavy mass, use a dab of epoxy to help carry the load. A lot of the problems I had with these boards were due to something like a support wire on one of the output coils coming loose on the underside of the board and causing intermittent open circuits. A little care in construction can make a big difference in reliability.

This project got started because the basic circuit board was so cheap that I just had to find a use for it. The guiding philosophy has been to keep the cost down by avoiding expensive or exotic parts. There are no crystals to be ordered and no strange ICs you have to mail away for; if your junk box doesn't have what you need, the local parts store probably does. This design approach has produced a rig whose performance is better than I had expected, but there are still improvements to be made by the experimenter. The thing which has the biggest payoff potential is an improved bfo. The 10.695-MHz technique works, but the bfo signal passes through all of the i-f stages of the receiver and that puts a limit on the i-f gain usable (before the receiver chokes on its own bfo) and probably generates some spurious responses as well. A bfo at 455 kHz has several advantages aside from the i-f considerations: The detector stage could be replaced with one of the simpler product detectors for better linearity, a separate agc detector could be included and the agc put back into service, and (though much less important) the S-meter could be hooked back up. There are two ways to go about adding the bfo—with and without a crystal. If you have or can get a 455-kHz crystal, you're all set; otherwise, you might try making a free-running oscillator with an old i-f transformer. The free-running version may work fine—after all, the frequency is low and drift certainly isn't the problem it used to be in the vacuum tube days.

In closing I would like to express my appreciation for the photography and help with the text tendered by Steve W1GSL. In a project of this size, it is easy to get lost in small details, so an impartial but informed observer is an invaluable aid.■

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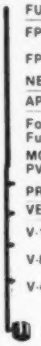

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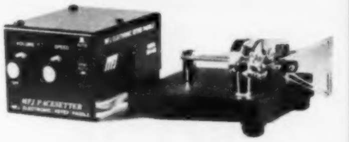

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Hands Across the Water

—CW lives on historic Cape Cod

The operator casually twirls the passband control of a $7,000 Watkins-Johnson receiver as he peels another CW signal off the side of a noisy pileup. He's been at it—slapping out 20-word-per-minute CW—for almost eight hours now. Soon his shift will be over and someone else will take his place.

As he concludes another contact, he habitually spins the antenna switch, sampling the various rhombics he uses for receiving while trying to pull yet another signal up out of the pack that has zero-beat on top of him. Europe, the Med, the Persian Gulf, Africa, the South Atlantic—as the rhombics click by, one signal finally surfaces above the rest.

Tapping his bug in response, the operator keys his remote transmitter. From the shore of a sleepy tidal marsh green with sea grass five miles away, his antennas—mostly doublets, dipoles, and curtains—march out toward the rolling Atlantic. Two 4-500s drive two 4-5000s and his signal is easily heard on the other side of the world.

After a brief exchange of formalities, the text of a message is passed between another ship at sea and the largest and oldest commercial CW station still operating in the United States: RCA Globecom's WCC. In a few minutes the shift will end, the paddle will be passed, and another watch in the life of a professional CW operator will come to an end on Cape Cod.

CALL	NAME
KB1AO	Ronald Farris
N1AVT	Walter Doucette, Jr.
K1GRM	James Richards
W1JE	William Fishback
W1KL	William Ryder
K1LJS	Lewis Masson
W1SCD	William Pyne
WA1SIY	Timothy Call
K1TV	Ralph Siebert
K1WF	William Farris, Jr.
K1WT	Wallace Turzyn
KA1YT	Phillip Davis
W4GEX	Robert Norloff

Fig. 1. List of hams working at WCC.

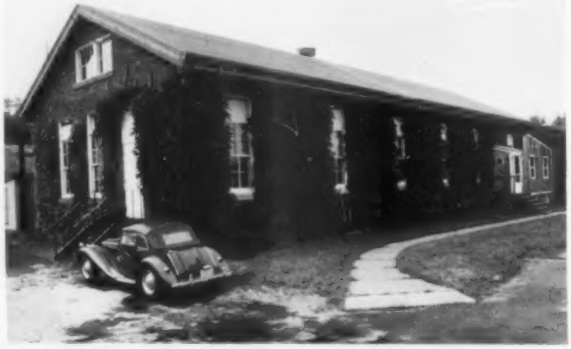

Fig. 2. In this rustic, ivy-covered building with a history as long as radio communication itself, 900 messages a day are handled by 21 professional CW operators, almost half of whom are hams.

Back In Time

Visiting WCC, RCA's marine message-handling station in the town of Chatham, Massachusetts, a good ways out on Cape Cod, is like taking a trip back through time. Once there, you're back in the Golden Age of shortwave radio communications. The rustic ivy-covered brick buildings, erected by the Marconi Company in 1914 (only eleven years after the first transoceanic radio

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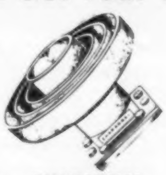

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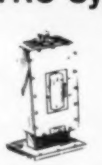

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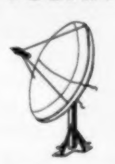

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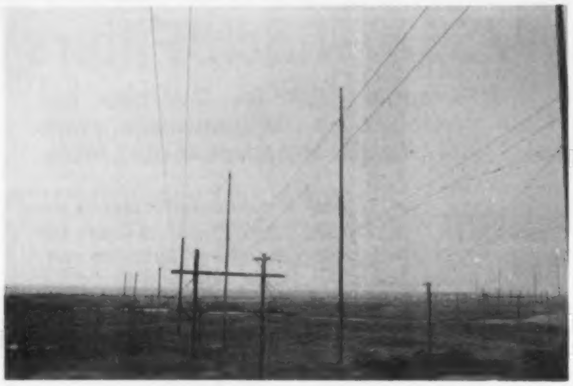

Fig. 3. At a remote transmitter site on the edge of a tidal marsh, WCC's antennas march out toward the Atlantic Ocean. These doublets and dipoles are fed with 10 kW of rf on 6, 8, 12, 16, and 22 megahertz.

RCA
Global Communications
Marine Radio Station
WCC

Fig. 4. A new sign welcomes visiting amateurs to RCA's oldest commercial radio facility.

message was sent from nearby South Wellfleet), are still intact. Most stand vacant now, victims of a technology to which they helped give birth. One, however, is as busy as ever.

Though methods of long-range radio communications have changed drastically during the last 60 years, the nobility of WCC remains. This station, which once provided weather information for Charles Lindbergh, maintained contact with Richard Byrd on his ill-fated trek to the pole, and monitored, then lost, Amelia Earhart's distant transmissions, has survived. And, in spite of the pressures for modernization, development, and progress surrounding them, these buildings, like the CW they shelter, are holding their ground in 1982.

What impresses most on a visit to WCC is the fact that in this high-speed, packet radio, orbiting-satellite world we live in, there is still a place where the Morse code is hammered out twenty-four hours a day, for a profit.

Edgar Hammons, manager of WCC: "Well, though we've seen a gradual decline over the last four years in the number of CW messages we handle, we're still quite busy." Though it may be on the decline, the WCC CW traffic list is, nonetheless, impressive. During the course of one twenty-four-hour operating day, 900 messages will be handled by WCC—most of them on CW. In rotating shifts, the station's 21 CW operators provide thousands of ships at sea with a reliable and inexpensive means of contacting their home offices.

"Satellites and digital communications are fine," says Hammons, but, he adds, "they are also extremely expensive to install and maintain." A modern shipboard satellite terminal can cost a ship owner over $50,000. As a result, many owners cling to CW and WCC as their only reliable communications link.

In addition to conventional CW, WCC offers customers with the proper equipment SITOR communications services. SITOR (Simplex Telex Over Radio) operates as an answer-back RTTY system. Running at 75 baud (50 wpm), SITOR transmitters and receivers at WCC echo message characters back to the ships that transmitted them. The result is error-free automated copy. In some instances, SITOR-equipped ships and their home offices can be connected directly through WCC for more private (and expedient) communications. A three-minute SITOR exchange with WCC costs an American ship about $9, a substantial savings over the CW rate which is based on a 52¢-per-word charge.

For the time being, however, CW is still the mainstay of WCC operations. After the hourly traffic list is broadcast by the station on the 4-, 8-, 12-, 16-, and 22-megahertz marine bands, CW signals pile up for each of the eight operators manning the shift. Once he establishes contact with a ship, a WCC operator types the text of the message he has received or sends the text of the message he is holding. Received messages at WCC are passed to one of three printer clerks via a small conveyor belt. The printer clerks then key the typewritten messages into a teleprinter that connects directly to an RCA message-center computer in New Jersey. At this point, the computer takes over and automatically telexes the message to its final destination.

The obvious thing about WCC's message-handling procedures is that they are highly labor intensive: It takes a lot of people to get a message delivered. According to manager Hammons, however, staffing the station poses little problem, despite its location on remote Cape Cod. "We have no openings here at present," says Hammons, "although we frequently do. In fact," he adds, "I have two applications for CW operator in my desk drawer right now. Tell your readers that I'm always glad to get new applications, though."

WCC's operating staff numbers 34; 21 are CW operators, nine are marine telex clerks, and four are technicians. There are 13 hams on the staff (See Fig. 1), almost 40% of the total employees! The starting salary for a CW operator is approximately $23,000 per year and the present contract calls for 10% yearly increases in wages.

Where does WCC find professional CW aficionados to man its station? Basically, there are two sources. Station operators come from the ranks of the military or from the ranks of amateur radio. Of the 21 full-time CW operators at WCC, eight are hams. In addition, all four technicians who attend to the day-to-day equipment maintenance and repair are hams.

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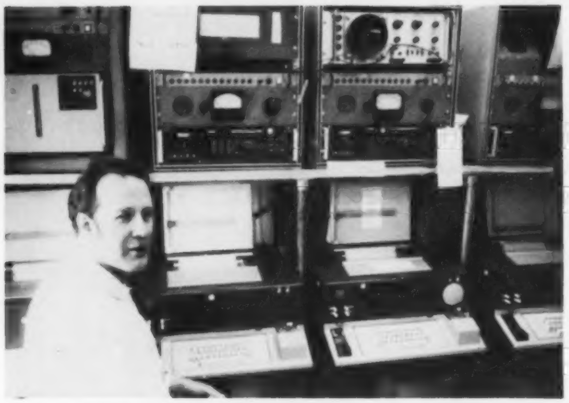

Fig. 5. K1TV manning the SITOR transmitter.

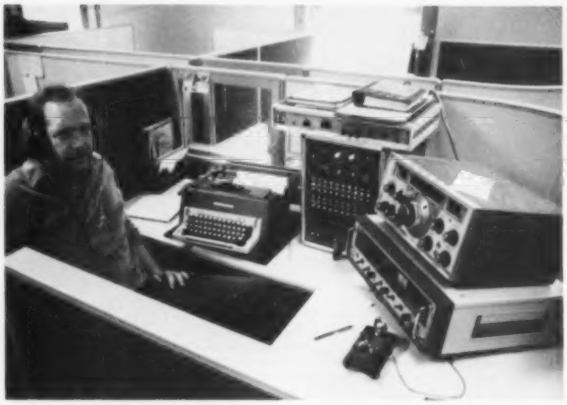

Fig. 6. A typical WCC operating position. Emphasis is put on receiver performance and typing ability.

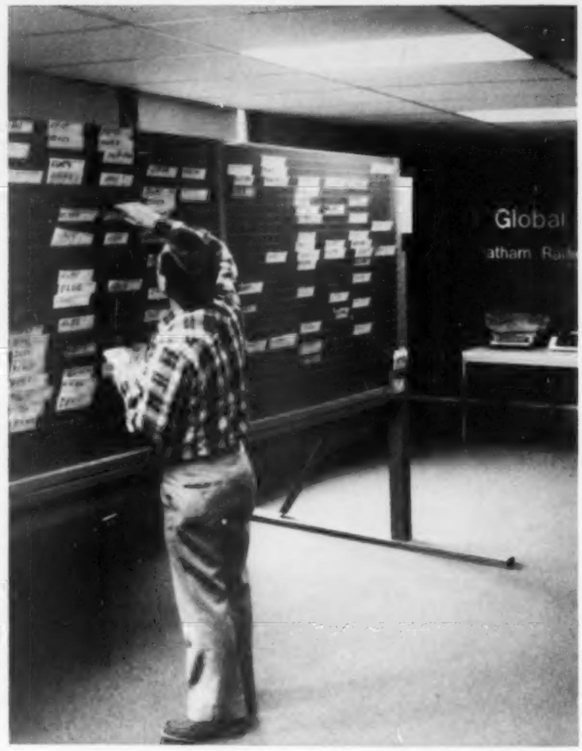

Fig. 7. Outgoing traffic is posted on the WCC message board. Between 700 and 1000 pieces of traffic are handled on a typical day.

hams operating at WCC includes a second class commercial telegraph license and a well-worn Vibroplex bug. Hand keys are available at each operating position, but, in a partial concession to modernity, most operators prefer to use their own mechanical keyer. No electronic keyers are in evidence, although one ham on the staff has been experimenting with the use of a CW keyboard.

Traffic at WCC is usually passed at around 15 words per minute but, in some cases, more slowly if the shipboard operator is not up to speed with the WCC crew. The quality of the code coming into WCC, both in tone and in style, varies. Some shipboard signals chirp like late-night Russian DX on 40 meters, and some of the fists sending these signals are straight out of the Novice bands.

Through it all, however, the cool professionalism of the WCC crew prevails. It is only rarely that the text of a message must be repeated by a tired operator in a distant port of call.

The Future at WCC

The future of WCC as a CW operation is open to question. Ed Hammons, conceding that CW is being eclipsed by the more cost-effective SITOR system, thinks CW will be around for some time, however. "I believe that we will always have Morse code," he said, adding that, "eventually it may not be the biggest segment of our business." Hammons went on to say that SITOR is gaining in popularity rapidly and that, at present, WCC is handling a new ship on SITOR almost every day.

For the CW operators at WCC, all of whom take turns babysitting the SITOR equipment now and then, CW remains more than a business; for most, it is a passion. One of them who argued most adamantly for the maintenance of high-quality standards on CW, as well as for the retention of CW as a requirement for amateur licensing, was not even a ham. He simply felt that CW was "something special, something human" in our digitally-automated world of tomorrow.

Sentimentality aside, the fact remains that a substantial portion of the message traffic that passes between the U.S. merchant fleet and their home offices in this information age in which we live does so via CW. For beleaguered CW stalwarts who constantly find themselves on the defensive when confronted by their SSB- or ASCII-loving ham brethren, that may be comforting to remember.

It may also be reassuring to remember that, should the cares of this modern information age become too great, there is an alternative. In a quiet village on old Cape Cod there is an ivy-covered building with a history as long as radio communications itself where a CW-loving ham can earn a decent living by pounding out ten kilowatts of Morse for all the ships at sea. All he needs is a love of CW and a well-broken-in, vintage Vibroplex bug.

Amateurs visiting Cape Cod are welcome to tour WCC. The station management requests that all visits be made between 8 am and 4 pm, weekdays only, and, when possible, arranged one day in advance. ■

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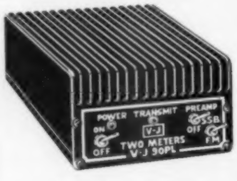

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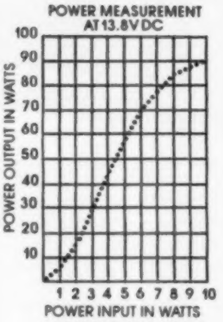

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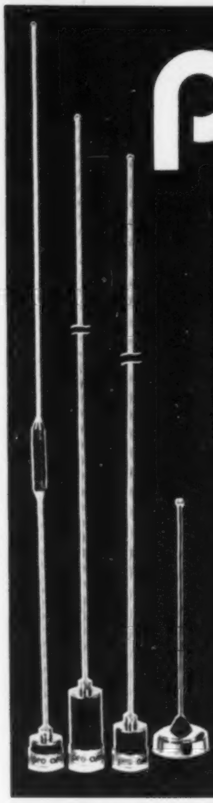

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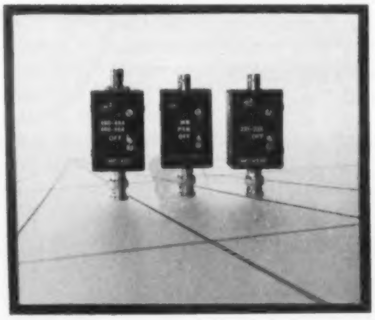

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A Three-Piece CPO

—battery not included

Recently, I had need of a code-practice oscillator to teach a Girl Scout troop how to properly send the international distress signals. We had already learned the emergency signals for ground-to-air, railroads, and the trucking industry. (How would *you* signal an oncoming train that a bridge was washed out?) It was just as important that the girls knew how to signal for help using Morse code. Hence, our program on emergency communications.

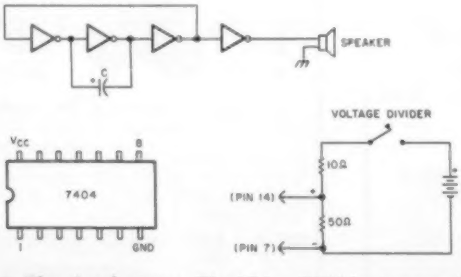

Fig. 1. The simplest cpo. The IC is a 7404 low-power Schottky hex inverter. C is a 5- to 30-µF electrolytic selected for desired pitch. The speaker is a 2-inch, 8-Ohm unit.

The cpo itself was built using 1 IC, 1 capacitor, and 1 speaker! The volume was sufficient for our meeting area and four C-cells wired in series provided the required 6 volts. Did I say 6 volts? Oh, yes, not wishing to build a 5-volt power supply (as required by the Schottky IC) for the circuit, I just used a voltage-divider network consisting of two resistors wired in series with the battery pack. One resistor was 10 Ohms, the other was 50 Ohms. The 50-Ohm resistor will function just like a miniature 5-volt battery. One end of the resistor will be the positive terminal and the other end will be the negative terminal. The current drain of the IC is so small that there is no problem with this arrangement.

The circuit was soldered directly to an IC socket and the speaker. I could have soldered directly to the IC pins, but happened to have a spare 14-pin socket in my junk box.

I used two 100-Ohm resistors in parallel to produce 50 Ohms. A standard 51-Ohm resistor would have worked just as well, as the maximum voltage for the IC is 5.25 volts.

The schematic diagram is self-explanatory. Build it and enjoy! ■

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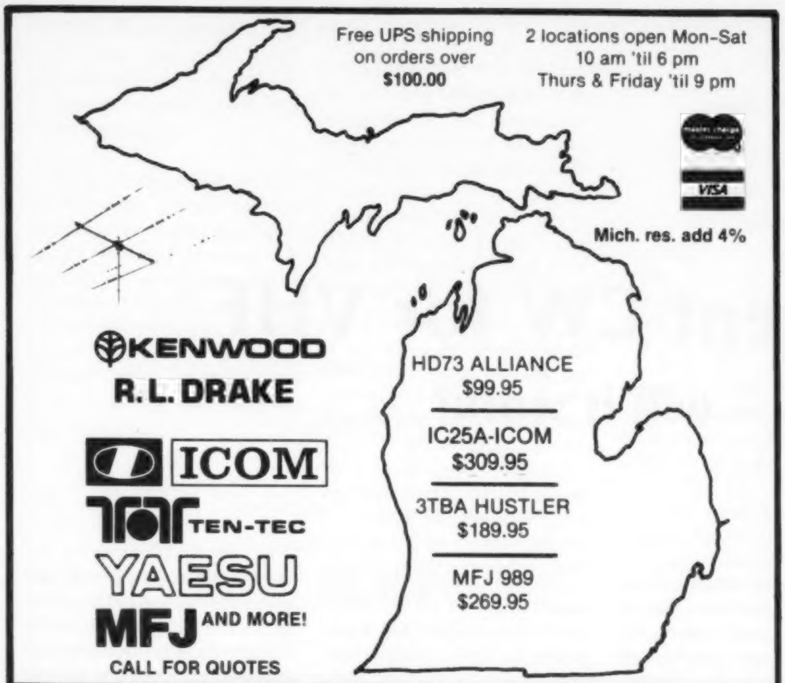

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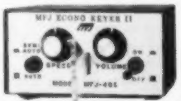

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Coherent CW for VHF

—will it work?

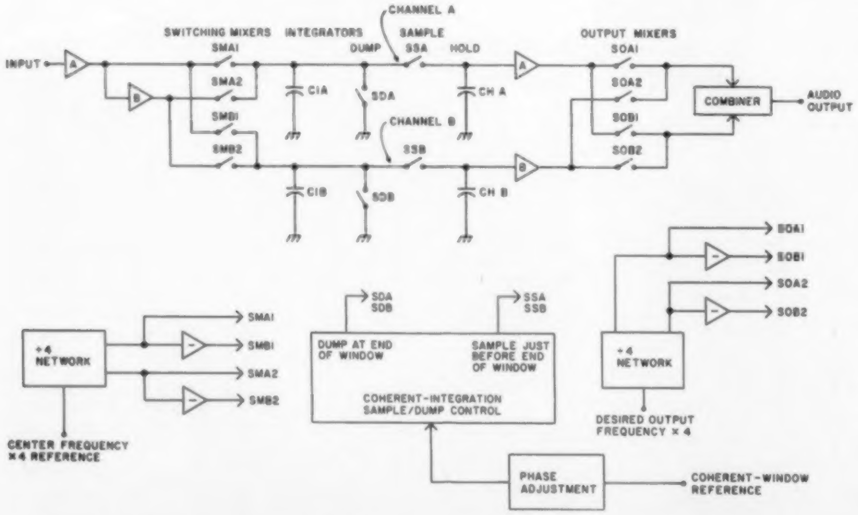
The so-called system of "coherent CW," which is actually a form of matched filtering with extremely narrow bandwidths, has been applied to the high-frequency spectrum and should have interesting VHF applications. Information is typically communicated at a bandwidth of only 10 Hz, resulting in a remarkably high signal-to-noise ratio. Successful contacts have been carried on at low power levels (such as 1 Watt) on 80 meters and over long distances (California to Asia) on 20 meters.

Interesting technical byproducts have been the development and use of the Petit filter with readily adjustable narrow bandwidths, the production and use of high-quality frequency synthesizers, and major advances in frequency stability, along with greatly improved methods of frequency measurement. Another important factor is the use of keyers with precision timing and phasing for each bit of each Morse element, using either the Accu-Keyer or special computer keying programs.

To our knowledge, the application of all of these technologies has not been made to VHF communication, but some of them may hold promise for important future advances at these higher frequencies.

Why Narrow Bandwidth at VHF?

The use of FM and the promise of packet communication of digital information at high speeds has drawn attention to the advantages of the wider bandwidths available at VHF. But for some applications, a completely opposite approach may be better. Suppose that we would prefer to get maximum range or highest intelligibility for only a brief message or one that might just as well go slowly. This could be, for instance, where the most important information might be evidence of contact through call letters and a signal report.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INTEGRATORS
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OUTPUT MIXERS
INPUT
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SMA1
DUMP
SSA
HOLD
SOA1
B
SMA2
C1A
SDA
CH A
SOA2
COMBINER
AUDIO OUTPUT
SMB1
CHANNEL B
SOB1
SMB2
SSB
SOB2
C1B
SDB
CH B
SOA1
SOB1
SOA2
SOB2
SDA SDB
SSA SSB
SMA1
SMB1
SMA2
SMB2
÷4 NETWORK
DUMP AT END OF WINDOW
SAMPLE JUST BEFORE END OF WINDOW
COHERENT-INTEGRATION SAMPLE/DUMP CONTROL
÷4 NETWORK
DESIRED OUTPUT FREQUENCY × 4
CENTER FREQUENCY × 4 REFERENCE
PHASE ADJUSTMENT
COHERENT-WINDOW REFERENCE

Fig. 1. Block diagram of the Petit filter (originally appeared in QST, May, 1981).

Let us make a simplifying assumption (not exactly true) that the methods of modulation and detection would be the same for either wide- or narrow-bandwidth communication and that the bandwidth required is the same as the bits sent per second. Curiously, 10 kHz completely filled for one second with 10,000 bits of information (as in a packet) would transmit exactly the same number of bits as 1,000 separate channels, each 10 Hz wide and each transmitting only 10 bits during the second (as in CCW). Noise power on each channel is proportionate to channel bandwidth. So, for the same signal-to-noise ratio, each narrowband signal using one milliwatt would do as well as the packet transmitter using 1 Watt. All the narrowband stations together would use

1 Watt—or if we preferred to use only one channel, we would use the same total amount of energy by taking 1,000 seconds to send the same message!

Thus, neither method has an inherent advantage in bits of information per unit of transmitted energy. So our choice will be made by whether we prefer speed at higher power or slowness at lower power (or perhaps greater range at the same power, at the sacrifice of speed).

We should note that if the total time is minimally used by packets or if the total frequencies are minimally used by lower-power narrowband signals, the chances of interference to either mode by the other mode in the same frequency range are very slight. Each tends to be immune to the other. (This will not apply, of course, if some greedy DXer tries a kilowatt on CCW!)

The Narrowband Matched Filter

We usually think of Morse code in terms of dot and dash patterns, each attached to a particular letter, number, etc. But Morse can be just as well conceived as a digital system based on an "on" (= one) or "off" (= zero) condition during a series of equal time intervals. Each time interval would be the length of a dot. A dot is a single one. A dash becomes three consecutive ones. A space within a character is usually one zero, between characters is three consecutive zeroes, and between words is seven consecutive zeroes.

If the timing of the Morse transmitter is precisely controlled, it will be sending a serial stream of digital information in classical binary form. Then a receiver can be constructed with a filter and detector carefully matched to decipher the digital message.

Despite the title of "coherent" CW, there is no way to preserve the phase coherence between the transmitted and received waves. Ionospheric or tropospheric media always cause some phase disturbances. The true essence of CCW is in the use of a matched filter.

At code speeds used by amateurs, bandwidths of matched filters can be extremely small. Typical dot lengths are a tenth of a second, producing about 12-wpm code speed. A Petit filter matched to such a signal has a 3-dB bandwidth of only 9 Hz. This allows for an outstandingly good signal-to-noise ratio.

The Petit Filter

The Petit filter refers to a design by Ray Petit W7GHM. Although the details of its circuit are described in the bibliography at the end of this article and will not be repeated here, a block diagram is shown in Fig. 1. The filter has several distinct features:

1. It operates near zero beat. Usually the filter bfo is at 1 kHz and it tunes to a receiver signal output very close to 1 kHz.

2. Two filter channels are used with a 90-degree phase difference between them. This quadrature phasing is necessary because near zero beat there is always the possibility that output in one channel alone might be in such a phase as to give almost no output. In that case, the quadrature channel output would be nearly maximum. Adding the two channels ensures an output whenever a signal is really present. The phase shift between the two 1-kHz-filter bfo signals is obtained by properly dividing 4 kHz by 4.

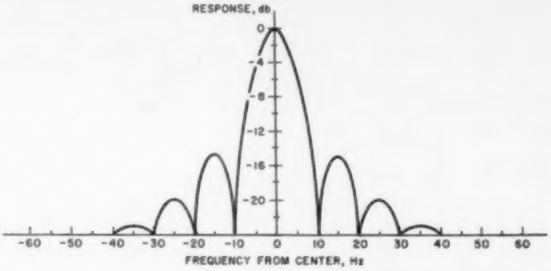

Fig. 2. Petit filter response curve (originally appeared in CQ, *June, 1977).*

3. Matching is achieved by using a high-precision secondary frequency standard to control all functions on both transmitter and receiver. This not only ensures close tolerance in receiver tuning (within 1 Hz), but also close synchronization between received digital pulses and filter pulse sampling. A controlled-pulse repetition rate is not sufficient to hold this synchronization; the phasing of the time sampled by the filter must also be adjusted so that the transmitted signal is framed within a "window" opened to each signal pulse. Ten phasing-switch positions allow adjustment of the framing in 10-ms steps. Initial adjustment is made by listening for the clearest reception of a series of transmitted dots.

4. Each 100-ms window opening is the result of an integrating circuit in each filter channel. The integrated output is remembered for the next 100 ms by a sample-and-hold circuit. The latter either sets the level of a tone modulator for audio readout or else crosses a threshold for digital detection. At the end of the 100-ms interval, the output of the integrator is dumped by a shorting switch so that the next sample can begin. Note that the total independence of each sampling time interval disallows the "ringing" so common to very selective bandpass filters. Ringing is a condition of slow buildup and decay that can make a Morse signal sound so mushy as to be unreadable. The Petit filter is immune to ringing.

The selectivity curve of the Petit filter is shown in Fig. 2. It does have side lobes that are still fairly high, although they remain quite close to center frequency. These side lobes might be diminished or eliminated by using other kinds of filters or by modifying the Petit filter. They are partly the consequence of the assumption in the design of the Petit type of filter that the Morse digital information is in pulses with zero rise and fall times—an inaccurate assumption.

Bandwidth may be adjusted easily by changing the sampling time interval. For instance, 1-second dot intervals will produce a bandwidth of only about 1 Hz, pulling signals out of the noise in a most impressive manner.

Signal-to-Noise Improvements

Some taped samples of 80-meter signals received by W3QVC and lab tests by W7GHM using the Petit filter are available for loan/purchase/copy from W3QVC at a minimal cost.

On an abstract numerical basis, signal-to-noise ratio is inversely proportional to receiver bandwidth. Thus, a 10-Hz-wide channel would give a signal-to-noise power advantage of 210 times (23 dB) compared to a 2100-Hz channel (a typical bandwidth for SSB voice communication).

In practice, the human ears and brain allow a degree of concentration on the single tone of a CW signal that is the equivalent of a much narrower bandwidth than the wider filter would indicate alone. This effect has varying evaluations. One estimate (Woodson, *QST*, May, 1981) is that "this skill is worth at least a 6-dB margin when using a 2300-Hz filter. QRM, however, is often a confusion factor and therefore causes more degradation of copy than an equivalent amount of random noise. These psychological factors are difficult to quantify, but probably reduce the advantage of CCW over ordinary CW."

Woodson then gives comparisons of CW and CCW at different power levels in 14-MHz communications in 1975 between JR1ZZR and W6BB. Both modes were taped simultaneously on separate stereo channels and each channel was played back to four moderately experienced CW operators. The conclusion saw "an estimated 13-W CW signal as equivalent to a 0.1-W CCW signal in communications effectiveness, or a 24-dB superiority for CCW." (He should have said "21 dB" for that power gain.)

The taped laboratory experiments of W7GHM indicate that a CW signal 5 dB below the white noise level using a 500-Hz filter is just barely audible and only occasionally readable. The addition of a 10-Hz-wide Petit filter brings it to an easily copied level at what Petit describes as a "signal-to-noise ratio of 12 to 15 dB."

When Petit then drops a signal 14 dB below the noise and changes his filter to only 1-Hz bandwidth, the results are truly astonishing. The signal goes from completely lost in the noise up to 15 dB above the noise—a gain of 29 dB!

Frequency Stability

A narrowband system can work only if its overall frequency stability is within its bandwidth. Channels 10 Hz wide will tolerate errors of only a few Hz. Two factors affect frequency stability: (1) phase changes due to variations in the propagation characteristics of the medium through which the wave is sent, and (2) the accuracy of the frequency-control systems for the transmitter and receiver.

Phase changes during propagation set an almost absolute limit to the narrowness of the bandwidth that can be used. How could we imagine, for instance, that a VHF signal broadly modulated by the undulations of aurora reflection could be contained within a 10-Hz channel?

So far we do have some experience with CCW in long-distance HF communication. Woodson says: "For 14-MHz signals, motion in the F layer typically produces 2 or 3 Hz of phase (or frequency) modulation for a JA to W6 path. (We have also observed what appears to be propagation time delays under poor band conditions.)" Woodson goes on to speculate about VHF applications: "CCW might be used for EME communication, but the problem is complicated because of lunar-motion Doppler effects. One might need a computer to calculate the frequency at which the signal is expected to return."

A more practical solution to the Doppler problem with satellite repeaters might be reached through tight phase-locking to the satellite beacon signal, followed by computerized selection of the receiver frequency for a given transmitter. Even this would involve the solution of a complex puzzle.

VHF experimenters will have to discover what atmospheric conditions will allow the practical application of CCW to the VHF and UHF bands. Exactly what phase shift is introduced in tropospheric propagation? Can frequency modulation be confined to 2 or 3 Hz? On what bands, under which circumstances?

Questions like these, with answers not yet available, determine the ultimate possible narrowing of bandwidths. But the picture is less cloudy, indeed hopeful, when we consider the area of equipment frequency control.

Secondary Frequency Standards

The accepted frequency accuracy for HF CCW equipment is one part in ten to the seventh power. This allows for an error of not more than 1 to 2 Hz in either the transmitter or the receiver—adequate for 10-Hz bandwidths. The required precision is met by carefully constructed room-temperature oscillators with temperature compensation through suitable capacitors across the crystal.

VHF CCW calls for at least an order of magnitude of improvement in frequency accuracy. Frequency standards dependable to one part in ten to the eighth are not so simple. They use excellent crystals and both crystal and oscillator are enclosed in two concentric proportionately temperature-controlled ovens. The one ray of hope for amateur use of these standards is that they are available on the surplus market from time to time, currently costing about $75.

The setting of the exact frequency of such a standard is also a problem—but not unsolvable. HF propagation phase shift makes WWV unusable for most people for standardizing frequency to better than one part in ten to the seventh. Higher accuracies can be obtained from one of three comparisons: (1) with WWVB at 60 kHz, (2) with Loran C at 100 kHz, or (3) with TV network colorburst signals.

Comparison With Primary Standards

Don Gross has developed a receiver that allows the signal from WWVB to gate a frequency counter. The frequency of his secondary standard is multiplied by ten, resulting in a 10-MHz wave to be counted. By using 100-second gate times, his standard can be measured to parts in ten to the ninth. Counting errors are typically only 1.4 digits (or 1.4 parts in ten to the ninth) during the midday hours when 60-kHz propagation is most stable. The addition of a voltage-variable capacitor to the frequency standard allows easy trimming adjustments to a part in ten to the ninth. Drift is so slight that such trimming is needed only two or three times a week.

Such high accuracies are possible when WWVB is received on a good balanced and shielded loop antenna and when the receiver bandwidth is narrow enough to provide a good signal-to-noise ratio. The Gross receiver converts the 60-kHz signal to 1.11 kHz, where it passes through an N-path filter only 0.1 Hz wide. It is then re-converted to 60 kHz, limited and zero-crossing detected, then frequency divided to provide the counter gate control. Both the down- and the up-conversions use heterodyning frequencies derived from the secondary standard.

Bert De Kat has developed an effective and fairly simple method of measuring frequency by using Loran C. He uses a switch-controlled frequency-divider system to derive from his secondary standard the pulse repetition rate (PRF) of any Loran C station. (This divider is derived from Fig. 7, Burhans, *73*, May, 1978, ignoring the slave window timer.) He sets his PRF to

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coincide with the nearest station and uses this locally-derived signal to trigger his oscilloscope. A broadbanded 100-kHz shielded loop and amplifier provide the Loran C signal to be displayed on the scope. By switching to a one-digit miscount in the divided frequency, the position of the display can be slowly moved across the screen until it reaches a suitable spot; the count is then corrected and the waveform stays in position. By using a high-grade oscilloscope, it is possible to expand any small portion of the 100-kHz waveform. By choosing the third zero-crossing of a pulse being built up, it is easy to keep track of the length of time that part of the wave moves across a measured part of the screen. This information can be used to measure the phase drift of the secondary standard. This measure is highly accurate, since the chosen part of the waveform is purely ground-wave and therefore stable in its propagation. Frequency is readily measured in parts in ten to the ninth or better.

Other methods of precise frequency measurement are covered in the bibliography.

Frequency Synthesizers

Since every frequency and timing element must be accurately controlled, high-quality frequency synthesizers are important. Ray Petit has done outstanding work in this direction. Although the bibliographic references to his synthesizers do not represent his latest developments, they show examples of excellent equipment that can be used to tune in either 100-Hz or 10-Hz increments, all phase-locked to the secondary frequency standard.

Keyers

The keyer that lends itself especially well to the timing requirements of CCW is the Accu-Keyer described in many issues of the ARRL *Radio Amateur's Handbook*. The oscillator part of this keyer is eliminated. A 10-Hz square wave derived from the frequency standard is connected in its place. This same 10 Hz is sent to the clock input of two D flip-flops: The Q output of one of these goes to the dot input of the keyer; the Q output of the other provides the dash input. The paddle (preferably a dual squeeze type) connects to the D inputs of the flip-flops. Debouncing can be arranged by connecting a resistor from each paddle output to the keyer positive voltage and a capacitor from each paddle to ground. CMOS versions of the Accu-Keyer are easily constructed and they are advantageous. The result of this circuit modification is a keyer that follows the desired CCW timing cycle to perfection.

Computerized keying is becoming increasingly popular. Some commercial keyers can be modified for the external timing and phasing required for CCW; others cannot. W3QVC had hoped that his M-80 Morse program for his TRS-80 would be adaptable to CCW. Although its keying speed can be fine tuned, its phase cannot be linked to the secondary frequency standard. As a result, with much that has been learned from volume 4 of the *Disassembled Handbook for the TRS-80* mentioned in the bibliography, he is encouragingly engaged in the production of a machine language Morse program for the TRS-80 (either Model I or Model III) that can use external clocking derived from his frequency standard.

Conclusion

CCW is just beginning to make its mark in amateur radio communication. With all the technological advances now at hand, there is every reason to consider the possible usefulness of CCW in the VHF range. There is plenty of room for new experiments! ■

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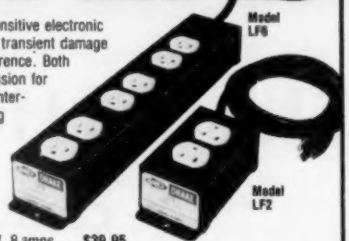

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Scientists studying "ill winds" have unearthed some amazing facts. First of all, there really *are* ill winds, air masses that produce nervous and physical symptoms in weather-sensitive people.

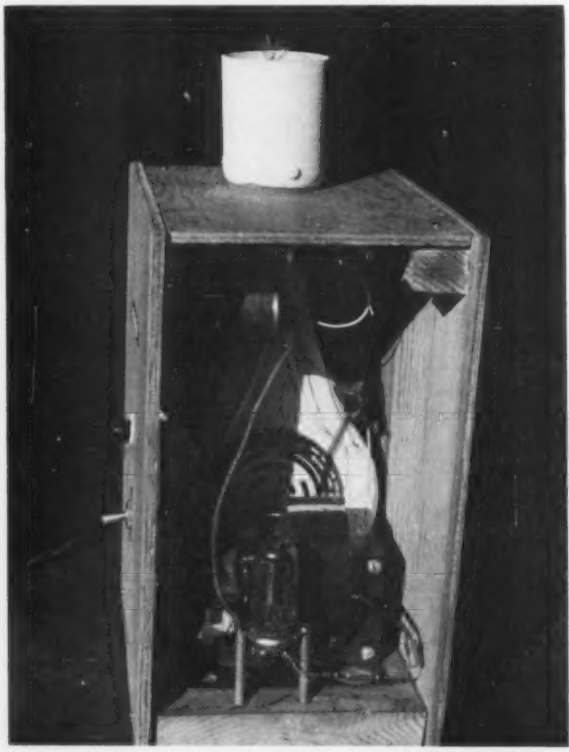
In our country, these symptoms have long been considered purely psychological, or just in one's mind, but in other countries such as Germany and Israel, they have long been related to bad winds, the Foehn in Germany and the Sharan in Israel.

Scientists have found that these air masses produce measurable changes in our bloodstream. And they believe they have found out how.

It seems that even before these winds sweep across an area, the positive ionization of the air increases enormously. In normal air, for every four negative ions there are five positive ions.

These positive ions in some way seem to increase the serotonin in the blood. This is a hormone whose properties are just now being investigated. Already we know serotonin has a great deal to do with our nervous condition, our moods, etc.

Before the ill winds come, the positive ionization of the air increases over 3000%. It's no wonder, then, that people can be affected. Doctors in Israel



Inside the ion generator. Old hair dryer (without heating elements) is used to disperse ions.

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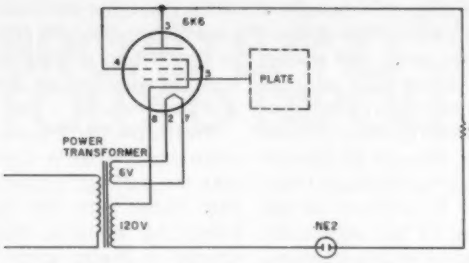


Fig. 1. Schematic of negative-ion-sensing electroscope.

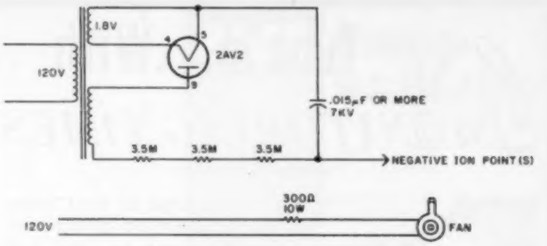


Fig. 2. Negative-ion generator.

often treat the nervous and physical ailments of their patients at these times by drugs that inhibit the action of serotonin, with almost magical results; moods change dramatically.

In our country, we also have such ill winds: the Santa Ana in California and the Chinook of the Rocky Mountains. You have perhaps experienced the exhilarating effects of the air at the seashore, near a waterfall, or in the mountains. In such places, the *negative* ions predominate.

As we become more and more "civilized," we also live in more completely air-conditioned environments. This air-conditioning not only warms or cools the air, it often deprives it of most of its negative ions. Air pollution outside our homes has the same effect. Tobacco smoke, besides being offensive to many noses, also depletes our working and living environments of negative ions, thereby adding to our nervous tension, so we pull out another cigarette, compounding the felony.

The mood we are in while we work is important. The Federal Aviation Administration is even studying the possibility that the imbalance in positive/negative ion concentration in cockpits may contribute to pilot error, resulting in dangerous situations for all on a flight.

This new knowledge of our environment and how it affects us has promoted the rise of several companies producing negative-ion generators, on the theory that if we can change the ion balance in our living or working environment to favor the negative-ion concentration, it will result in better feelings and better work, as well as help purify the air.

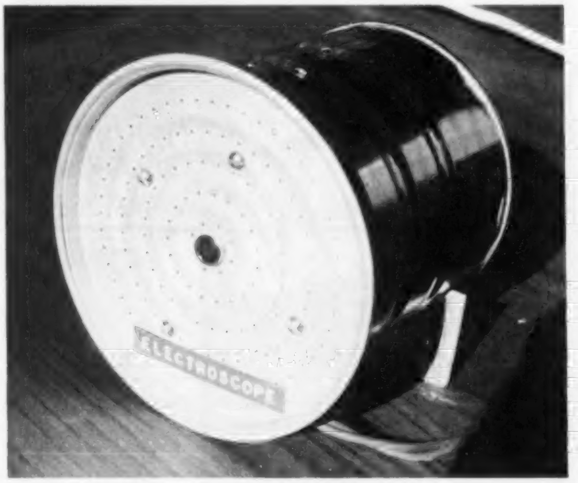
Most of these companies are really trying to give us something for our money, but some do it better than others. Some ion generators produce mostly ozone, which is not the negative ions we want; in fact, it has been found detrimental to health.

Later in this article I will detail how you can build your own negative-ion generator. But first we should have a way of telling whether we are really getting negative ions or positive ions or just ozone. We can't see any of these. Ozone we can detect if our nose is in good functioning condition, but only our moods could tell us whether there are too many positive ions in our environment.

So, although we can produce our own negative ions, we need a method of detecting these helpful ions. What we need is a negative electroscope. You may be familiar with electroscopes used in high-school science classes, two-leaf affairs made of thin foil which separates when electrostatically charged. The difficulty with these is that they will react to either a positive *or* a negative charge. So we still are in the dark as to which ions we have generated, if any.

The Negative Electroscope

Fig. 1 shows how to build a simple *negative* electroscope which reacts to a concentration of negative ions. As you may know from your knowledge of vacuum tubes, a negative charge on the grid of a tube prevents current from flowing in the tube. In this circuit the grid is connected to a pick-up plate some five inches (13 cm) in diameter. When this plate is in a nega-



Outside view of electroscope.

Inside the electroscope.

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tive field (negative ions produce a negative field), it places this negative charge on the grid of the tube and the neon bulb in the plate circuit goes out, showing that current in the tube has been cut off by a negative charge on the grid.

Any triode tube may be used, or a multi-element tube with the screen grid connected to the plate (ignore other elements except filament, cathode, and grid). If the cabinet is made of wood or plastic, you don't need the isolation transformer. But be careful that no high voltage is on any external surface.

I found an aluminum plate from a discarded percolator to be about the right size. I mounted the neon bulb (with its resistor) in the ready-made hole in the center of this plate. Then it was simple to mount a small filament transformer and the tube socket to the back of this plate. I didn't use an isolation transformer as only the plate connected to the grid can be touched from outside, and it has only the voltage of the surrounding air.

Usually the neon bulb will be on because the ordinary air conditions are positive, which allows some plate current to flow. Touching the plate will sometimes cause the neon to go out, but more often than not it will light brighter. You can experiment with this electroscope by combing your hair and bringing the comb next to the plate or walking across the carpet towards the plate. As you will find, most of the static charges produced are of a positive polarity and will make the neon glow even brighter.

The Negative Ionizer

To build the negative ionizer (Fig. 2), I bought a surplus 6-kV transformer, formerly used for a bugkiller. If you have an electronic background and don't mind the size of your ionizer, there is an alternative to a high-voltage transformer. If you have an old working TV set, you could, with some wiring changes, bring out the *negative* high-voltage lead of your TV flyback power supply and use it to generate your negative ions. The anode lead going to the picture tube is positive. In front of the ordinary TV set you will find an overabundance of positive ions. Perhaps this is partly the cause of our moody reaction to television!

I used an ordinary 2AV2 tube for rectifying the high voltage. If you have some very high-voltage diodes, these could be used, but they are not as tolerant of sparks and corona discharge as tubes are.

Build the whole ionizer in a wooden or plastic case or insulate heavily—five or six kilovolts is lethal! The extra 10-megohm resistor (actually three 3.5M resistors) is in the positive lead to ensure that anyone coming into accidental contact with the cathode, or negative-ion lead, will not be seriously shocked. According to Ohm's Law, this 10M resistance would allow about 0.7 mA of current to flow. You probably get much more than this in the thousand-volt shock you get by walking across the carpet and touching someone.

Despite this 10M precaution, shield the negative-ion point or cluster as well as possible from prying fingers. Be sure to keep the whole apparatus *out of reach* of children altogether. The shock that one can get from this ionizer is not serious but could easily produce a jerk of the arm that could upset and knock down the ionizer with more serious consequences. As when you open the back of your TV set, the best advice is: Don't! And the next best is: Know what you are doing and *be careful!*

The capacitor I used to store up the 6-kV charge was the 0.015-μF capacitor that came with the bugkiller. To build a better charge, a higher capacity could be used here (but be sure it is a high-voltage type). With the 6 kV, I had some trouble with arcing and corona discharge at the tube socket. The 10M resistor helped reduce this, and some anti-corona spray made it manageable. The corona discharge usually produces positive ions, so it is undesirable.

I first made the negative discharge element a point (a filed-down iron nail), but later added some extra points to increase the discharge. Perhaps you would like to use a piece of copper mesh such as is used in cleaning utensils. In any case, try to shield this in some way or keep it out of reach of children.

I found the 6-kV bugkiller transformer had enough space to wind a few extra turns on, to light up the filament of the 2AV2. If you can't do this or decide to use another rectifier, a separate transformer could be used for the filament. One advantage to using a high-voltage diode would be the saving of this extra transformer.

I also enclosed in my box an old hair-dryer blower (the heating element had burned out). In series with this I connected a 10-W resistor to slow it down a bit. In this way I had a slight breeze blowing up out of the ionizer to disperse the negative ions generated. But this is a refinement that may not be necessary.

"An ill wind blows no one good" says an old adage. Build this ionizer and be prepared to combat this invisible menace. ■

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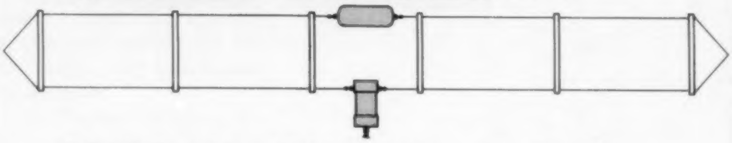

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- It's simple. (*You* can build it in less than an hour. You don't have to understand—just follow the pictures and the instructions.)

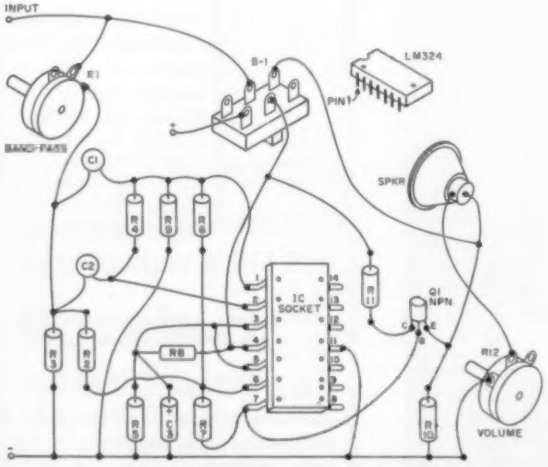

Fig. 1.

So if you're tired of crackles, pops, roars, whistles, and worse yet, interfering stations, this is the gadget for you. You can dial them out almost like magic!

The filter uses only one integrated circuit, the LM-324 quad op amp, which is available at Radio Shack for about $1.50. Also required are some resistors and capacitors, a speaker, and a power supply (batteries will do). If you'd rather travel by Cadillac than skateboard, add a phone jack and construct a power supply as shown in Fig. 3.

The design is nothing new—as a matter of fact, it is based on a filter design shown in the spec sheet for the LM-324. We have added to the design to provide for an adjustable bandpass, and we have tried to write simple directions for construction. Those who are experienced builders are not likely to need or follow our instructions, so we are writing for the person who has never, ever even seen an integrated circuit.

Decisions, Decisions, Decisions

OK, if you are convinced that you can live no longer with QRM and QRN, it's time to make some decisions.

(a) What kind of cabinet? How about a cigar box; maybe a small plastic box; or try one of those small metal card-file boxes from the stationery counter at Woolco.

(b) Chassis—Experienced builders will probably use perfboard or printed circuits, but beginners will probably do better with a small piece of plywood, about 3" × 5". Use small nails for terminals or tie-points, preferably soldered.

(c) Power supply—The operating voltage can be anything from 5 to 14 volts. The unit draws 120 mA at 9 volts. An ordinary 9-volt transistor radio battery will give about 4 hours continuous service, but four C or D cells in series will last several hours longer. (Later we will discuss the elimination of the transistor post-amplifier. Without the transistor, the unit draws only

20 mA at 9 volts. Your battery would last a long time assuming you remember to turn off the power when the unit is not in use.)

If you opt to construct a power supply to operate from house current, try the one in Fig. 3. It's simple and inexpensive.

(d) Phones, speaker, or both?—The design shows a speaker within the unit, but if you feel you might want to use phones, install a phone jack. Sorry, we can't draw a picture for this; there are just too many types of phone jacks. Consider, though, that the output of the filter is at a constant volume regardless of the input. Many times you will hear a signal at full volume that you cannot hear at all with the unaided ear. You don't have to depend on phones to pick out the weak ones.

(e) Center frequency—This unit should have a center frequency (in its sharpest mode) of about 700 Hz. That is, *if* capacitors C1 and C2 are actually 0.1 uF. Unfortunately, capacitors are flighty things; the actual capacitances are almost never the same as the marked capacitances. So, "ye pays yer money, and ye takes yer chances." More likely, the center frequency will be about 5% to 10% below the designed center frequency. If you would like a different center frequency, the Design Notes give alternative component values.

About Construction

The LM-324 looks like a fat centipede. Pins are numbered counterclockwise beginning to the left of the notch when viewed from the top. (Remember, George, that's clockwise when viewed from the bottom or pin side.) Most ICs also have a small dot marking pin 1. If this is your first IC project, invest six bits in a 14-pin wire-wrap IC socket (that's the one with the long pins). It'll save a lot of cussing—believe it!

The bandpass control (R1) may be 50k to 100k Ohms. The filtering is sharpest when R1 is set at a high resistance, and when R1 is very low, the bandpass is so wide it seems there is no filter at all. When R1 is at 80k Ohms or higher, the bandpass is less than 4% of the center frequency, which is too narrow for ordinary CW use. Most noise disappears when R1 is set at about 30k Ohms, and a setting of 50k Ohms will narrow the bandpass to less than 40 Hz.

Make your connections to the power switch (S1) so that when the power is off, the signal is bypassed around the unit direct to the speaker. See the illustration in Fig. 1.

The transistor used as a post-amplifier needs to have a power dissipation rating of better than 1.5 Watts. The 2N2222 can handle this, but if you substitute another NPN, check it after a couple of minutes of use to see if it is heating too much. You may control this by putting 50 to 150 Ohms resistance between the plus voltage terminal and the collector of the transistor. (This is shown in the drawing as R11. Naturally, if the transistor you use can handle the power without overheating, you may eliminate R11.)

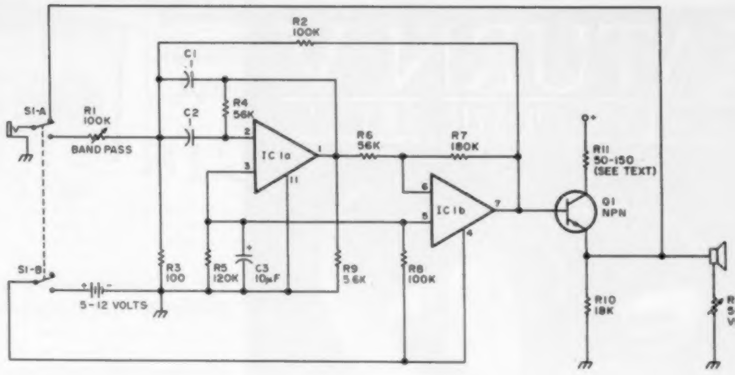

Fig. 2.

PARTS LIST
(All resistors ¼ Watt)

R1	50k Ohm to 100k Ohm variable resistor
R2, R8	100k Ohms
R3	100 Ohms
R4, R6	56k Ohms
R5	120k Ohms
R7	180k Ohms
R9	5.6k Ohms
R10	18k Ohms
R11	50 to 150 Ohms (see text)
R12	500 Ohm variable resistor
C1, C2	.1 uF
C3	10 uF
C4	1000 uF
Q1	2N2222 or equivalent NPN transistor (see text)
IC1	LM-324 quad op amp integrated circuit
S1	Double-throw, double-pole slide switch

Small speaker
Battery (see text)
For optional power supply see Fig. 3.
IC socket 14-pin wire wrap

The LM-324 filter produces reasonable volume into a small speaker without further amplification. If your shack is not noisy, simply connect one leg of your speaker to pin 7 of the LM-324 and eliminate transistor Q1 and also resistors R10, R11, and R12. The volume will then be enough to be heard clearly from a distance of 10 to 15 feet. (Remember the weak signals sound just as loud as the strong ones.)

Using the Filter

Connect the input of the filter to the phone jack or external speaker connections of your rig. Turn R1 to

Design Notes
Desired Center Frequency

Component	710 Hz	816 Hz	850 Hz	1020 Hz
R4, R6	56k	51k	47k	39k
R2 (R4 × 1.5)	82k	75k	72k	62k
R3 (R4/623)	91	82	75	62
R5	120k	100k	100k	100k
R7 (R4 × 3)	160k	150k	150k	120k
R8	100k	100k	100k	100k
R9	5.6k	5.6k	5.6k	5.6k

(Computed to nearest standard values—R4 and R6 are considered critical. Other values may vary up to 25%.)

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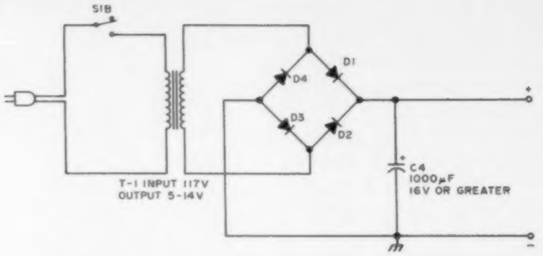

Fig. 3. Simple power supply. D1-D4 can be almost any diodes, or use full-wave bridge (Radio Shack 276-1161).

its lowest resistance setting. With the power on, you can hear both the desirable and undesirable as you tune across the band. When you have located the signal you want, narrow the filter by adjusting R1, bandpass control, until the undesirable is eliminated. (You may have to slightly retune your receiver as you tighten down on the filter, but you'll soon learn to recognize the center frequency and tuning will be fast and easy.) Keep the volume of the receiver as low as possible. If you get a chug-a-chug sound, you're using too much volume. Remember, the filter will pick up some signals when the volume is turned so low you can't hear them ordinarily.

We've tried to keep it simple—so if you're too tired to build this yourself, give this article and the parts to one of the kids. ■

Editor's Note

Shortly before publication, *73* learned that R5 should be changed to 68k for best performance. Please note this change.

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The True-Blue Keyer

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Editor's Note: The 8044 keyer chip used here is available from Curtis Electro Devices, Box 4090, Mountain View CA 94040; telephone (415)-964-3846.

This article describes a project that started as a typical electronic keyer and ended up including a self-contained readout that displays words per minute (wpm). This keyer is unique because of its ability to digitally display the speed in wpm of the keyer IC before either the dot or dash paddle is closed. Additionally, it will display the sender's speed in wpm during a CW transmission. These features were designed into the project using all CMOS technology and mechanical coupling between the keyer and image clocks.

The project features common keyer controls such as speed, volume, tone, weight, sidetone on/off, and transmitter tune with added front-panel switches for display calibrate and image/keyer display.

Circuit Operation

The use of a calibrated, tracking image clock is the circuit's simple method of generating a clock frequency when there is no clock output from the keyer IC, as in a standby condition. When the operator starts sending CW with the paddles, the logic circuitry transfers the wpm display from reading the image clock to reading the keyer clock. The display is updated every 1.2 seconds and will show the correct wpm after the first two update periods. A lower CW speed than the preset level will register if the operator is not sending at the proper rate and with the correct spacings. This feature provides visual feedback, telling the operator if his fist needs some correction. The display will never show a wpm level in excess of the preset value no matter how fast the paddles are actuated because the counter records only the number of clock pulses for 1.2 seconds generated by a particular frequency (speed) selected by the speed control.

SPEED
VOLUME
TONE
WEIGHT
DISPLAY KEYER
WPM
20
POWER
TUNE
SIDETONE
CLOCK
CALIBRATE
W3BYM

Display keyer.

Upon completion of the last CW character and, hence, the last keyer clock pulse, the display will show a reduced wpm or even zero for a short interval. Again, the logic functions and the display shows the output of the image clock.

Circuit Description

The display keyer can best be described by separating it into three sub-circuits. The block diagram of Fig. 1 shows these circuits in their simplest form for those interested in following the logic sequence.

The heart of the system is the 8044 IC. This sub-circuit is shown in Fig. 2. Generally, I used the published circuit* with a few modifications. As shown in Fig. 2, these mods were not major circuit changes but just use of what the 8044 had to offer. For instance, the dot and dash terminals (pins 2 and 7) are normally high during standby. This was used very conveniently to drive the Exclusive NOR, U4a, a CD4077. Another connection to pin 8 of the 8044 was used for clock frequency pick-off to drive the counter and display circuit (Fig. 4) via an FET bilateral switch, U5a, 1/4 of a CD4066.

Another switch, U5c, was wired to the base of the 2N1613 driver transistor. This FET switch grounds the base of the driver transistor when U4b, pin 11 (Fig. 3), is high, thereby preventing the transistor from being keyed during clock calibration.

The output keying transistor, a 2N4356, is configured to drive a grid-block input circuit. Choice of this transistor will depend on your transceiver's grid-block voltage. My HW-101 presents −50 V dc at the key jack, so this transistor with its BVceo of 80 V dc has an adequate margin.

---

*8044 Keyer Data Sheet, Curtis Electro Devices, Inc., revised February 23, 1979.

The final mod to the keyer circuit was the addition of the dual, 500k single-shaft pot. The keyer clock is controlled by R1A, while R1B (Fig. 3) controls the image clock frequency. Use of this dual pot mechanically couples the two clocks together to provide proper tracking and the correct wpm display during standby conditions.

The second sub-circuit is shown in Fig. 3. All of the switching and timing functions are controlled by this circuit. The positions of FET switches U5a and U5b as well as SW1 and SW2 are in a standby, ready-to-transmit mode. The logic states of the CD4077 that are useful for this circuit are L+L=H, H+H=H, H+L=L. The following logic states exist for Fig. 3 as shown. U4a pins 1 and 2 are high, thus pin 3 is high. U4c pin 6 is high and pin 5 is low, thus pin 4 is low. U2 is wired as a positive retriggerable monostable. With U2 pins 8 and 12 low, pin 10 will be low. U4d pins 8 and 9 are low, thus pin 10 is high. U4b pin 12 is high and pin 13 is low, thus pin 11 is low and U5c is open.

During standby conditions, the image clock, U3, wired as a free-running astable has its output pin 10 routed to the counter via the closed bilateral FET switch, U5b.

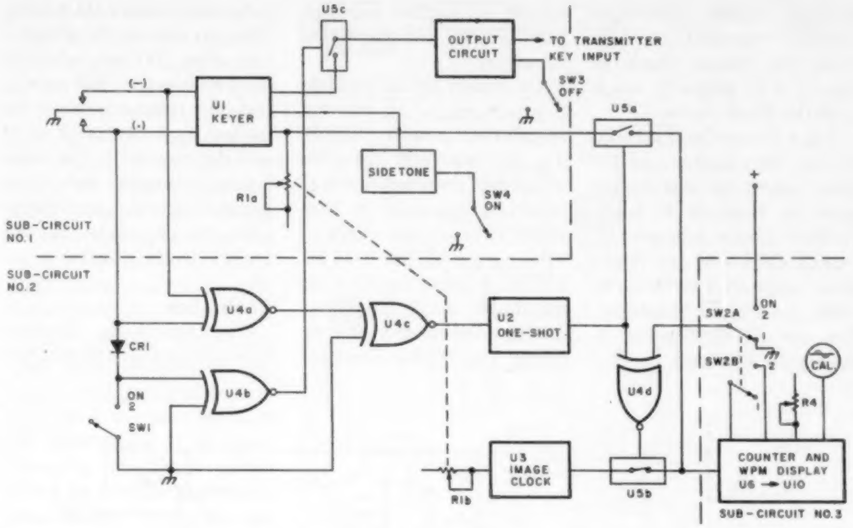
U5c
OUTPUT CIRCUIT
TO TRANSMITTER KEY INPUT
SW3 OFF
(−)
(-)
U1 KEYER
U5a
SIDETONE
R1a
SW4 ON
+
SUB-CIRCUIT NO. 1
SUB-CIRCUIT NO. 2
U4a
U4c
U2 ONE-SHOT
SW2A
ON 2
1
CR1
SW2B
2
CAL
ON 2
U4b
U4d
R4
SW1
1
U3 IMAGE CLOCK
R1b
U5b
COUNTER AND WPM DISPLAY U6 → U10
SUB-CIRCUIT NO. 3

Fig. 1. Display keyer block diagram.

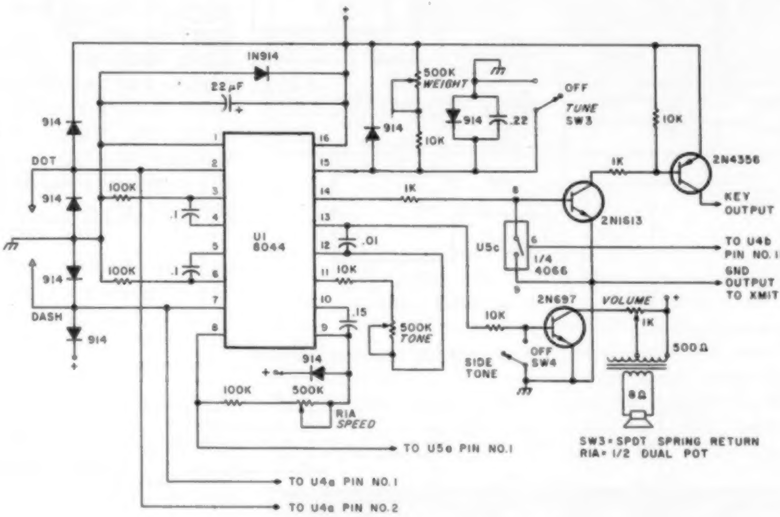
+
IN914
22μF
500K WEIGHT
OFF
TUNE SW3
914
914
.22
10K
10K
DOT
914
100K
.1
U1 8044
1K
8
2N4356
KEY OUTPUT
2N1613
.01
U5c
1/4 4066
TO U4b PIN NO. 11
GND OUTPUT TO XMIT
914
100K
.1
10K
9
DASH
10K
.15
2N697
VOLUME
1K
500Ω
914
500K TONE
914
SIDE TONE
OFF SW4
8Ω
100K
500K
R1A SPEED
TO U5a PIN NO.1
SW3=SPDT SPRING RETURN
R1A=1/2 DUAL POT
TO U4a PIN NO.1
TO U4a PIN NO.2

Fig. 2. Keyer and output circuits.

When a dot or dash paddle is closed, U4a's input state will become either L+H=L or H+L=L. As you can see, U4a's output will be forced low in either case. This low is inverted by the controlled inverter, U4c, whose positive output triggers U2. U2's monostable pulse width is set to four seconds by the 1 meg and 1μF RC combination. This pulse width was selected to accommodate low-speed operation, which may include long pauses. If the pause is greater than the pulse width, the display will revert back to the image clock. As long as this condition exists, the display will continue to show random numbers as it bounces between the two clock outputs. U2 pin 10 will remain high for positive retrigger pulses arriving at its input within the four-second on-time. U4d pin 8 now remains high, which forces pin 10 low and opens U5b. The high on U2 pin 10 also controls U5a, causing this switch to close and routing the 8044's clock output to the counter and display circuit. The display now registers the wpm of the transmitted CW up to the maximum set by the speed control.

The logic transfers just described will remain in effect until there is a pause greater than four seconds. Upon completion of the last paddle closure, either a dot or a dash, U2 is retriggered for its last cycle. After four seconds, all logic states will revert back to the standby condition, with the display showing the image clock wpm. During this transition, the display may show a double-zero indication because there is no clock output from the 8044 and U2 has not returned to zero on pin 10, closing U5b and opening U5a.

The image clock, U3, uses R1b for setting the clock output on pin 10.

Rcal is a 100k multi-turn trimpot required to calibrate the image clock so that it will properly track with the 8044 clock.

Fig. 4 shows the third subcircuit, the counter and display. Credit for this circuit goes to Howard F. Batie W7BBX whose fine article, "QRQ, QRS—By the Numbers," appeared in the June, 1980, issue of *73 Magazine*. The circuit description is throughly covered in this article, so further explanation would just duplicate his effort.

Dc power for all circuits is produced by an internal regulated power supply (Fig. 5). The 7808 three-terminal 8-V dc regulator was selected because it provides at least two volts of Vdd margin for the 8044 IC. This IC is rated for 10 V dc maximum while all other CMOS used have a 20-V dc rating. The 7808 is rated for 1 Ampere steady-state load. The circuits in this project can draw 200 mA, which is well within the 7808 rating, but the regulator must be bolted to a heat sink or it will destroy itself. The regulator's mounting tab is its ground terminal and therefore can be electrically attached to the chassis.

Calibration

The following description is based on all switches positioned as shown in Figs. 2, 3, and 4 and the paddles are open.

After ac power is applied, I suggest a warm-up time of five minutes. If all circuits are working properly, the display should indicate a two-digit number.

The 8044 IC is capable of 8 to 50 wpm with the values shown. The image clock was calibrated using Rcal and a speed setting of 30 wpm. This provides tracking within 1 to 2 wpm from 8 to 30. Above 30 wpm, I experienced difficulty in getting proper tracking because of nonlinearities in the image clock. If the speed control is advanced above 30, the image display will increase very rapidly and show a false number. At these higher speeds, with the paddles open, a momentary indication of the correct speed is available when the front-panel clock switch is transferred to the 8044 position. During CW transmission, the display will read correctly for any speed over 30 wpm.

SW1 is an SPDT spring-return switch used during calibration of the image clock

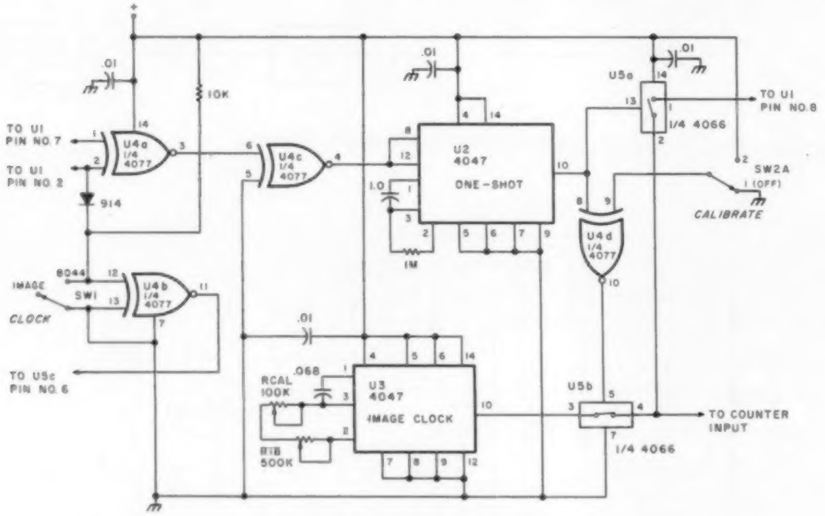
+
.01
10K
TO U1 PIN NO. 7
TO U1 PIN NO. 2
U4a 1/4 4077
914
8044
IMAGE
SW1
CLOCK
U4b 1/4 4077
TO U5c PIN NO. 6
U4c 1/4 4077
U2 4047 ONE-SHOT
1.0
1M
U3 4047 IMAGE CLOCK
RCAL 100K
.068
R1B 500K
U5a
1/4 4066
TO U1 PIN NO. 8
SW2A
1 (OFF)
CALIBRATE
U4d 1/4 4077
U5b
1/4 4066
TO COUNTER INPUT

Fig. 3. Display sequencing logic.

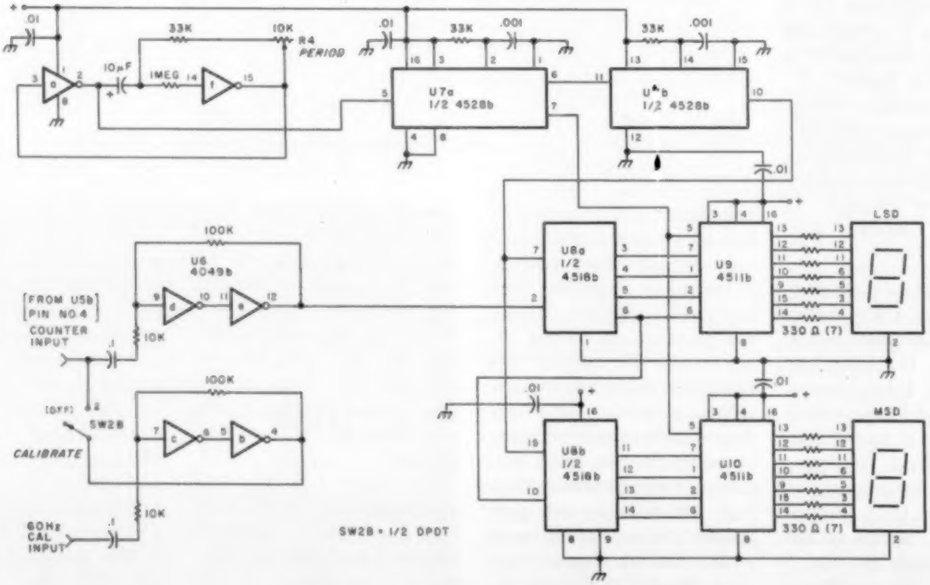
+
.01
33K
10K
R4 PERIOD
10µF
1MEG
.001
U7a 1/2 4528b
U7b 1/2 4528b
100K
U6 4049b
FROM U5b PIN NO. 4
COUNTER INPUT
.1
(OFF)
SW2B
CALIBRATE
60Hz CAL INPUT
SW2B = 1/2 DPDT
U8a 1/2 4518b
U9 4511b
LSD
330 Ω (7)
U8b 1/2 4518b
U10 4511b
MSD

Fig. 4. Counter and wpm display circuit.

to match the 8044 clock. When SW1 is closed, the high on U4b pin 12 via the 10k pull-up resistor is grounded. This does two things: First, the 8044 is turned on through the 1N914 between U4a pin 2 and U4b pin 12. Second, U4b pin 11 goes high, which closes U5c, preventing any transmitter keying during clock calibration. The image clock could be calibrated by simply closing the dot paddle, but this is not recommended because the transmitter would be keyed unnecessarily.

SW2 is a standard DPDT toggle switch used to change the logic state on U4d pin 9 for counter period calibration. A high on pin 9 and a low on pin 8 will force U4d pin 10 low and open switch U5b. With switches U5a and U5b open, the counter input is open and ready to accept the 60-Hz calibration signal.

The counter circuit calibration uses SW2b to connect U6b pin 4 to the input of U6d pin 9. The remaining counter and display circuitry was used as it appeared in W7BBX's article.

The first calibration step is to set the period, or gating time, of the frequency counter. This time period is controlled by adjusting R4 in Fig. 4. Incidentally, I recommend that a multi-turn trimpot be used for R4 to reduce the sensitivity of this adjustment. The calibration source is a low-voltage 60-Hz signal from the transformer secondary. With 60 Hz and a 1.2-second gating period, the wpm calculates to be 72. Therefore, with the front-panel Calibrate switch (SW2) up, R4 should be varied until a steady reading of 72 registers on the display. Remember to rotate R4 slowly, allowing the counter to count all the pulses during the gating time. When this step is complete, return SW2 to the down position.

The second calibration step involves setting the output frequency of the image clock to coincide with the 8044 clock at 30 wpm. Pressing the front-panel Clock switch (SW1) presents the 8044's clock to the counter/display circuit and registers it directly in wpm. The idea here is to adjust the 100k trimpot, Rcal (Fig. 3), so the image clock matches the 8044 clock. Next, release SW1 and adjust Rcal for the correct wpm. Rotate the Speed control (R1A/B) counterclockwise and check for proper tracking at lower settings.

This completes the calibration for the display keyer and only leaves the remaining keyer controls, which are self-explanatory.

Component layout isn't critical. For ease of fabrication and checkout, I constructed the counter/display circuits on one perfboard and the keyer with switching/timing logic on another. The power supply is mounted to a third perfboard with the 7808 near the center. The regulator's metal heat sink is connected to the rear chassis wall.

The display keyer project was fun to design and build and with its completion has added another dimension to my CW operation. The usefulness of the wpm readout has proved to be more than expected, with its constant reminder of CW speed. Besides being useful on the air, the project makes an excellent CW practice machine. The trainee can develop and improve both his speed and coordination using the display and sidetone as indications of his sending quality. ■

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LM 565N	Phase Locked Loop	1.40	1.20
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MC 1330	Video Detector	2.49	1.89
MC 1349	Video If Amp	2.06	1.85
MC 1350	Video If Amp	1.75	1.55
MC 1352	Video If Amp AGC	2.09	2.09
MC 1358	Audio If Amp	1.95	1.79
MC 1374P	R.F. Modulator	3.19	2.87
MC 1458	Dual Comp. Op Amp	.88	.79
MC 1496N	Balanced Mod/Demodulator	1.79	1.59
LM 1800	PLL Stereo Decoder	4.49	3.95
LM 1889	Video Modulator	2.95	2.49
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LM 7805	5 Volt Positive Volt. Reg.	1.39	1.25
LM 7808	8 Volt Positive Volt. Reg.	1.39	1.25
LM 7812	12 Volt Positive Volt. Reg.	1.39	1.25
LM 7815	15 Volt Positive Volt. Reg.	1.39	1.25
LM 7818	18 Volt Positive Volt. Reg.	1.39	1.25
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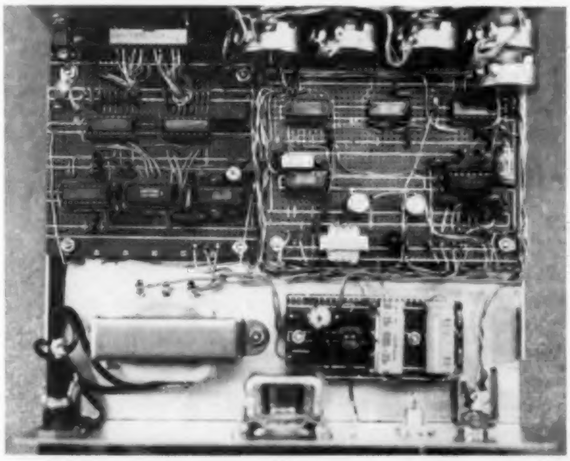

Top view of the display keyer, showing the three perfboards. Speaker, ac fuse, input and output jacks are on the rear panel.

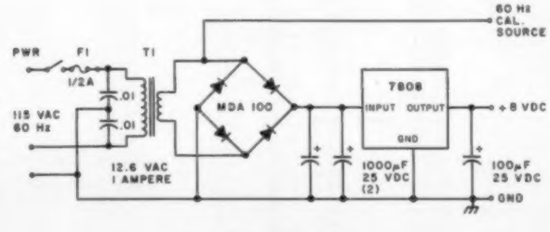

Fig. 5. Power supply.

Louis C. Graue K8TT
624 Campbell Hill Rd.
Bowling Green OH 43402

Touch-Type CW

— the TRS-80 way

Program listing.

```
               00100 ;TRS-80  CW KEYBOARD BY K8TT (9/8/80)
               00110 ;SENDS CW OUT THE CASSETTE AUXILLARY PLUG
               00120 ;SHIFT KEY + UP ARROW WILL INCREASE SPEED
               00130 ;SHIFT KEY + DOWN ARROW WILL DECREASE SPEED
               00140 ;BREAK KEY CLEARS SCREEN AND STOPS OUTPUT
               00150 ;TO ENTER MESSAGE: HIT @ THEN 1,2,3, OR 4 -
               00160 ;      TYPE IN MESSAGE - HIT (BREAK) WHEN DONE.
               00170 ;TO SEND MESSAGE: HOLD (SHIFT) & PRESS 1,2,3,OR 4.
               00180 ;
               00190 ;INITIALIZATION
4A00           00200         ORG     04A00H
4A00 CDC901    00210 START   CALL    01C9H   ;CLEAR
4A03 3E00      00220         LD      A,0     ;STOP OUTPUT
4A05 D3FF      00230         OUT     (0FFH),A
4A07 3E5F      00240         LD      A,05FH  ;TURN ON CURSOR
4A09 322240    00250         LD      (4022H),A
4A0C 21003C    00260         LD      HL,3C00H        ;SET OUTPUT CURSOR
4A0F 220050    00270         LD      (5000H),HL
4A12 21006A    00280         LD      HL,06A00H       ;INITIALIZE BUFFER
4A15 EB        00290         EX      DE,HL           ;DE IS REAR
4A16 21006A    00300         LD      HL,06A00H       ;HL IS FRONT
4A19 3600      00310         LD      (HL),0  ;NO OUTPUT BEFORE INPUT
               00320 ;
               00330 ;INPUT-OUTPUT CALLING SEQUENCE
4A1B CD234A    00340 AGAIN   CALL    INPUT
4A1E CD674A    00350         CALL    OUTPUT
4A21 18F8      00360         JR      AGAIN
               00370 ;
               00380 ;STORE KEY ENTRIES IN BUFFER AND DISPLAY ON CRT
4A23 D5        00390 INPUT   PUSH    DE
4A24 E5        00400         PUSH    HL
4A25 CDA54B    00410         CALL    KEYSCN
4A28 E1        00420         POP     HL
4A29 D1        00430         POP     DE
4A2A B7        00440         OR      A       ;FIX FLAG
4A2B C8        00450         RET     Z       ;GO TO OUTPUT IF NO INPUT
4A2C FE01      00460         CP      01H     ;IF BREAK KEY CLEAR
4A2E 28D0      00470         JR      Z,START ;          & STOP SENDING
4A30 FE1A      00480         CP      01AH    ;SPEED DECREASE
4A32 CA4B4B    00490         JP      Z,DECSPD
4A35 FE1B      00500         CP      01BH    ;SPEED INCREASE
4A37 CA544B    00510         JP      Z,INCSPD
4A3A FE40      00520         CP      40H     ;ENTER MESSAGE
4A3C CA1A4C    00530         JP      Z,MSTART
4A3F FE21      00540         CP      21H     ;MESSAGE #1
4A41 CA794C    00550         JP      Z,MES1
4A44 FE22      00560         CP      22H     ;MESSAGE #2
4A46 CAA84C    00570         JP      Z,MES2
4A49 FE23      00580         CP      23H     ;MESSAGE #3
4A4B CAD74C    00590         JP      Z,MES3
4A4E FE24      00600         CP      24H     ;MESSAGE #4
4A50 CA064D    00610         JP      Z,MES4
4A53 E5        00620         PUSH    HL
4A54 D5        00630         PUSH    DE
4A55 CD3300    00640         CALL    33H     ;VIDIO OUTPUT
4A58 D1        00650         POP     DE
4A59 E1        00660         POP     HL
4A5A FE08      00670         CP      08H     ;ERASE LAST ENTRY
4A5C 2004      00680         JR      NZ,MODEL
4A5E 2B        00690         DEC     HL
4A5F 3600      00700         LD      (HL),0
4A61 C9        00710         RET
4A62 77        00720 MODEL   LD      (HL),A
4A63 2C        00730         INC     L       ;BUMP BUFFER
4A64 3600      00740         LD      (HL),0  ;ZERO NEXT BYTE  OF BUFFER
4A66 C9        00750         RET
               00760 ;
               00770 ;OUTPUT CW TO CASSETTE PORT  FROM BUFFER
4A67 1A        00780 OUTPUT  LD      A,(DE)  ;GET  DATA
4A68 B7        00790         OR      A       ;FIX FLAG
4A69 C8        00800         RET     Z       ;GO IF BUFFER EMPTY
4A6A FE20      00810         CP      20H     ;SPACE?
4A6C CA184B    00820         JP      Z,WSPACE;IF SO, SEND IT
4A6F FE5B      00830         CP      05BH    ;REJECT NON TABLE STUFF
4A71 F29A4A    00840         JP      P,GOOF
4A74 4F        00850         LD      C,A     ;SAVE CHAR FOR SEND
4A75 D62C      00860         SUB     02CH    ;MAKE START OF TABLE  0
4A77 FA9A4A    00870         JP      M,GOOF
4A7A D5        00880         PUSH    DE
4A7B E5        00890         PUSH    HL
4A7C 6F        00900         LD      L,A     ;MAKE DATA 16 BIT
4A7D 2600      00910         LD      H,0
4A7F 11754B    00920         LD      DE,TABLE;GET BASE ADDR OF TABLE
4A82 19        00930         ADD     HL,DE   ;FIND ELEMENT BY INDEXING
4A83 7E        00940         LD      A,(HL)  ;GET CODE FROM TABLE
4A84 E1        00950         POP     HL
4A85 D1        00960         POP     DE
4A86 0608      00970         LD      B,08H   ;BIT COUNTER
4A88 07        00980 NEXT    RLCA            ;LOOK FOR 0 TO START
4A89 05        00990         DEC     B
4A8A 280E      01000         JR      Z,GOOF  ;NO START BIT - NO SEND
4A8C 38FA      01010         JR      C,NEXT
4A8E 07        01020 MORE    RLCA            ;NEXT BIT  INTO CARRY
4A8F 3834      01030         JR      C,DASH  ;IF 1 SEND DASH
4A91 CD9C4A    01040         CALL    DOT     ;IF 0 SEND DOT
4A94 05        01050 DARET   DEC     B
4A95 20F7      01060         JR      NZ,MORE ;GET  NEXT BIT
4A97 CDF64A    01070         CALL    CSPACE  ;SPACE AT END OF CHAR
4A9A 1C        01080 GOOF    INC      E      ;BUMP BUFFER
4A9B C9        01090         RET
               01100 ;
               01110 ;DOT ROUTINE
4A9C F5        01120 DOT     PUSH    AF
4A9D C5        01130         PUSH    BC
4A9E DDE5      01140         PUSH    IX
4AA0 E5        01150         PUSH    HL
4AA1 3E2E      01160         LD      A,2EH           ;INSERT DOT AS SENT
4AA3 CD694B    01170         CALL    CURS            ;FIX SENDING CURSOR
4AA6 E1        01180         POP     HL
4AA7 DDE1      01190         POP     IX
4AA9 3E01      01200         LD      A,1
4AAB D3FF      01210         OUT     (0FFH),A
4AAD CD5D4B    01220         CALL    DELAY
4AB0 DDE5      01230         PUSH    IX
4AB2 E5        01240         PUSH    HL
4AB3 3E20      01250         LD      A,20H           ;CLEAR THE DOT
4AB5 CD694B    01260         CALL    CURS
4AB8 E1        01270         POP     HL
4AB9 DDE1      01280         POP     IX
4ABB 3E00      01290         LD      A,0
4ABD D3FF      01300         OUT     (0FFH),A
4ABF CD5D4B    01310         CALL    DELAY
4AC2 C1        01320         POP     BC
4AC3 F1        01330         POP     AF
4AC4 C9        01340         RET
               01350 ;
               01360 ;DASH ROUTINE
4AC5 F5        01370 DASH    PUSH    AF
4AC6 C5        01380         PUSH    BC
4AC7 DDE5      01390         PUSH    IX
4AC9 E5        01400         PUSH    HL
4ACA 3E5F      01410         LD      A,5FH           ;INSERT DASH
4ACC CD694B    01420         CALL    CURS
4ACF E1        01430         POP     HL
4AD0 DDE1      01440         POP     IX
4AD2 3E01      01450         LD      A,1
4AD4 D3FF      01460         OUT     (0FFH),A
4AD6 0E03      01470         LD      C,03H
4AD8 C5        01480 DAHDLY  PUSH    BC
4AD9 CD5D4B    01490         CALL    DELAY
4ADC C1        01500         POP     BC
4ADD 0D        01510         DEC     C
4ADE 20F8      01520         JR      NZ,DAHDLY
4AE0 DDE5      01530         PUSH    IX
4AE2 E5        01540         PUSH    HL
4AE3 3E20      01550         LD      A,20H           ;CLEAR THE DASH
4AE5 CD694B    01560         CALL    CURS
4AE8 E1        01570         POP     HL
4AE9 DDE1      01580         POP     IX
4AEB 3E00      01590         LD      A,0
4AED D3FF      01600         OUT     (0FFH),A
4AEF CD5D4B    01610         CALL    DELAY
4AF2 C1        01620         POP     BC
4AF3 F1        01630         POP     AF
4AF4 189E      01640         JR      DARET
               01650 ;
               01660 ;CHARCTER SPACE ROUTINE
4AF6 F5        01670 CSPACE  PUSH    AF
4AF7 DDE5      01680         PUSH    IX
4AF9 E5        01690         PUSH    HL
4AFA 79        01700         LD      A,C             ;GET CHARACTER BACK
4AFB CD694B    01710         CALL    CURS
4AFE 23        01720         INC     HL              ;BUMP CURSOR ADDR
4AFF DD7500    01730         LD      (IX+0),L        ;SAVE NEW CURSOR ADDR
4B02 DD7401    01740         LD      (IX+1),H
4B05 E1        01750         POP     HL
4B06 DDE1      01760         POP     IX
4B08 3E00      01770         LD      A,0
```

I have been looking for a good program to make it possible for me to use my TRS-80 computer to send CW over the air. I wrote this one, with the following features:

- The transmitter is keyed through the cassette auxiliary plug and does not use the TRS-80 relay.
- Input and output speeds are independent so that you can type well ahead of what is being transmitted.
- The output speed can be increased or decreased at any time by holding the shift key and pressing the up or down arrow key.
- The input is displayed on the screen and can be edited before it is sent out by using the backspace key.
- The character being output is indicated by being removed temporarily from the CRT display, with the dots and dashes displayed in its place as they are sent. Afterwards the character is replaced. This goes on simultaneously with the addition of new characters. You always know exactly where the sending routine is operating.
- Messages can be typed out on the screen, edited, and then stored for later output. When called, the entire message is instantly placed on the screen in the proper sequence and is treated exactly like text you are typing.
- Hitting the break key will clear the screen and the buffers and stop the output.
- The output is perfect machine code of whatever is put on the CRT, including proper spaces.

Operation

Using Edtasm or Tbug, make an object program tape and load it. Operation is extremely simple. Just start typing and anything you type will be displayed and sent.

If you want a faster output speed, hold the shift key and press the up arrow key. Each time you do this, the speed is incremented. To decrease the speed, use the down arrow key in the same way.

To store a message for later use, first press the @ key and then key 1, 2, 3, or 4. Type in your message (up to 256 characters), edit it,

```
4B0A D3FF      01780          OUT     (0FFH),A
4B0C 0E02      01790          LD      C,02H
4B0E C5        01800 CSDLY    PUSH    BC
4B0F CD5D4B    01810          CALL    DELAY
4B12 C1        01820          POP     BC
4B13 0D        01830          DEC     C
4B14 20F8      01840          JR      NZ,CSDLY
4B16 F1        01850          POP     AF
4B17 C9        01860          RET
               01870 ;
               01880 ;WORD SPACE ROUTINE
4B18 F5        01890 WSPACE   PUSH    AF
4B19 DDE5      01900          PUSH    IX
4B1B E5        01910          PUSH    HL
4B1C 3E2D      01920          LD      A,2DH                ;SPACE MARKER
4B1E CD694B    01930          CALL    CURS
4B21 E1        01940          POP     HL
4B22 DDE1      01950          POP     IX
4B24 3E00      01960          LD      A,0
4B26 D3FF      01970          OUT     (0FFH),A
4B28 0E04      01980          LD      C,04H
4B2A C5        01990 WSDLY    PUSH    BC
4B2B CD5D4B    02000          CALL    DELAY
4B2E C1        02010          POP     BC
4B2F 0D        02020          DEC     C
4B30 20F8      02030          JR      NZ,WSDLY
4B32 DDE5      02040          PUSH    IX
4B34 E5        02050          PUSH    HL
4B35 3E20      02060          LD      A,20H                ;CLEAR SPACE MARKER
4B37 CD694B    02070          CALL    CURS
4B3A 23        02080          INC     HL                   ;BUMP CURSOR
4B3B DD7500    02090          LD      (IX+0),L             ;SAVE IT
4B3E DD7401    02100          LD      (IX+1),H
4B41 E1        02110          POP     HL
4B42 DDE1      02120          POP     IX
4B44 F1        02130          POP     AF
4B45 FE20      02140          CP      20H
4B47 CA9A4A    02150          JP      Z,GOOF
4B4A C9        02160          RET
               02170 ;
               02180 ;SPEED CHANGE ROUTINES
4B4B 3AA44B    02190 DECSPD   LD      A,(SPEED)
4B4E C610      02200          ADD     A,10H
4B50 32A44B    02210          LD      (SPEED),A
4B53 C9        02220          RET
4B54 3AA44B    02230 INCSPD   LD      A,(SPEED)
4B57 D610      02240          SUB     10H
4B59 32A44B    02250          LD      (SPEED),A
4B5C C9        02260          RET
               02270 ;
               02280 ;        DELAY ROUTINE
4B5D 3AA44B    02290 DELAY    LD      A,(SPEED)
4B60 3D        02300 LOOP1    DEC     A
4B61 F5        02310          PUSH    AF
4B62 CD234A    02320          CALL    INPUT
4B65 F1        02330          POP     AF
4B66 20F8      02340          JR      NZ,LOOP1
4B68 C9        02350          RET
               02360 ;
               02370 ;FIX THE SENDING CURSOR ROUTINE
4B69 DD210050  02380 CURS     LD      IX,5000H
4B6D DD6E00    02390          LD      L,(IX+0)
4B70 DD6601    02400          LD      H,(IX+1)
4B73 77        02410          LD      (HL),A
4B74 C9        02420          RET
               02430 ;
4B75 B3        02440 TABLE    DEFB    0B3H      ; ,
4B76 FF        02450          DEFB    0FFH      ; DUMMY
4B77 95        02460          DEFB    095H      ; .
4B78 D2        02470          DEFB    0D2H      ; /
4B79 DF        02480          DEFB    0DFH      ; 0
4B7A CF        02490          DEFB    0CFH      ; 1
4B7B C7        02500          DEFB    0C7H      ; 2
4B7C C3        02510          DEFB    0C3H
4B7D C1        02520          DEFB    0C1H
4B7E C0        02530          DEFB    0C0H
4B7F D0        02540          DEFB    0D0H
4B80 D8        02550          DEFB    0D8H
4B81 DC        02560          DEFB    0DCH
4B82 DE        02570          DEFB    0DEH
4B83 FF        02580          DEFB    0FFH
4B84 FF        02590          DEFB    0FFH
4B85 FF        02600          DEFB    0FFH
4b86 FF        02610          DEFB    0FFH
4B87 FF        02620          DEFB    0FFH
4B88 8C        02630          DEFB    08CH
```

```
4B89 FF        02640          DEFB    0FFH
4B8A F9        02650          DEFB    0F9H
4B8B E8        02660          DEFB    0E8H
4B8C EA        02670          DEFB    0EAH
4B8D F4        02680          DEFB    0F4H
4B8E FC        02690          DEFB    0FCH
4B8F E2        02700          DEFB    0E2H
4B90 F6        02710          DEFB    0F6H
4B91 E0        02720          DEFB    0E0H
4B92 F8        02730          DEFB    0F8H
4B93 E7        02740          DEFB    0E7H
4B94 F5        02750          DEFB    0F5H
4B95 E4        02760          DEFB    0E4H
4B96 FB        02770          DEFB    0FBH
4B97 FA        02780          DEFB    0FAH
4B98 F7        02790          DEFB    0F7H
4B99 E6        02800          DEFB    0E6H
4B9A ED        02810          DEFB    0EDH
4B9B F2        02820          DEFB    0F2H
4B9C F0        02830          DEFB    0F0H
4B9D FD        02840          DEFB    0FDH
4B9E F1        02850          DEFB    0F1H
4B9F E1        02860          DEFB    0E1H
4BA0 F3        02870          DEFB    0F3H
4BA1 E9        02880          DEFB    0E9H      ;X
4BA2 EB        02890          DEFB    0EBH      ;Y
4BA3 EC        02900          DEFB    0ECH      ; Z
4BA4 A0        02910 SPEED    DEFB    0A0H      ;A0H=15WPM - 50H=30WPM
               02920 ;
               02930 ;KEYSCN ROUTINE
4BA5 213640    02940 KEYSCN   LD      HL,4036H
4BA8 010138    02950          LD      BC,3801H
4BAB 1600      02960          LD      D,00H
4BAD 0A        02970 CHECK    LD      A,(BC)
4BAE 5F        02980          LD      E,A
4BAF AE        02990          XOR     (HL)
4BB0 73        03000          LD      (HL),E
4BB1 A3        03010          AND     E
4BB2 2008      03020          JR      NZ,SRB
4BB4 14        03030          INC     D
4BB5 2C        03040          INC     L
4BB6 CB01      03050          RLC     C
4BB8 F2AD4B    03060          JP      P,CHECK
4BBB C9        03070          RET
4BBC 5F        03080 SRB      LD      E,A
4BBD 7A        03090          LD      A,D
4BBE 07        03100          RLCA
4BBF 07        03110          RLCA
4BC0 07        03120          RLCA
4BC1 57        03130          LD      D,A
4BC2 0E01      03140          LD      C,01H
4BC4 79        03150 AGN    LD        A,C
4BC5 A3        03160          AND     E
4BC6 2005      03170          JR      NZ,FOUND
4BC8 14        03180          INC     D
4BC9 CB01      03190          RLC     C
4BCB 18F7      03200          JR      AGN
4BCD 3A8038    03210 FOUND    LD      A,(3880H)
4BD0 47        03220          LD      B,A
4BD1 7A        03230          LD      A,D
4BD2 C640      03240          ADD     A,40H
4BD4 FE60      03250          CP      60H
4BD6 3013      03260          JR      NC,TEST
4BD8 CB08      03270          RRC     B
4BDA 3031      03280          JR      NC,SCHR
4BDC C620      03290          ADD     A,20H
4BDE 57        03300          LD      D,A
4BDF 3A4038    03310          LD      A,(3840H)
4BE2 E610      03320          AND     10H
4BE4 2828      03330          JR      Z,DLY
4BE6 7A        03340          LD      A,D
4BE7 D660      03350          SUB     60H
4BE9 1822      03360          JR      SCHR
4BEB D670      03370 TEST     SUB     70H
4BED 3010      03380          JR      NC,COMPUT
4BEF C640      03390          ADD     A,40H
4BF1 FE3C      03400          CP      3CH
4BF3 3802      03410          JR      C,SHBIT
4BF5 EE10      03420          XOR     10H
4BF7 CB08      03430 SHBIT    RRC     B
4BF9 3012      03440          JR      NC,SCHR
4BFB EE10      03450          XOR     10H
4BFD 180E      03460          JR      SCHR
4BFF 07        03470 COMPUT   RLCA
4C00 CB08      03480          RRC     B
4C02 3001      03490          JR      NC,CODE
```

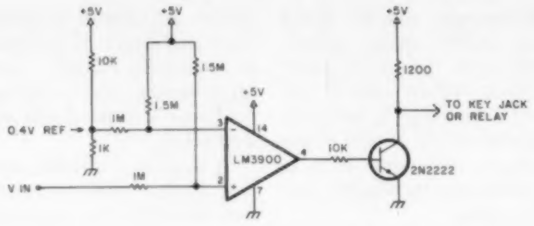

Fig. 1.

and after it appears on the screen just as you want it, press enter to store it. Up to four different messages can be stored.

When you want to send the stored message, hold the shift key and press 1, 2, 3, or 4 according to which message you want. The entire message will appear on the screen immediately after anything you have already typed in and will be sent in proper sequence when the output program gets to it.

Whenever you want to kill the output, hit the break key and you can start over.

The Program

The keyscan (02BH) subroutine in the ROM monitor contains a 17-millisecond delay. I had to rewrite this and put it in this program without that delay. Otherwise, typing in characters would mess up the output timing. Also, you will notice that I have used the keyscan subroutine as the major part of the timing loops for output of code. This is the trick that makes it appear that output and input are independent.

The output cursor is stored at 5000H and adjusted as necessary by using index addressing. The input cursor is handled by the monitor program.

The message routines were greatly simplified by making use of the subroutine in the monitor at 40H. All I had to do was put the start of the message buffer in HL. The subroutine then stores the message and

```
4C04 3C        03500         INC     A
4C05 215000    03510 CODE    LD      HL,0050H
4C08 4F        03520         LD      C,A
4C09 0600      03530         LD      B,00H
4C0B 09        03540         ADD     HL,BC
4C0C 7E        03550         LD      A,(HL)
4C0D 57        03560 SCHR    LD      D,A
4C0E 010100    03570 DLY     LD      BC,01H
4C11 CD6000    03580         CALL    60H
4C14 7A        03590         LD      A,D
4C15 FE01      03600         CP      01H
4C17 C0        03610         RET     NZ
4C18 EF        03620         RST     28H
4C19 C9        03630         RET
               03640         ;
               03650         ;ENTER MESSAGE ROUTINE
4C1A CD2B00    03660 MSTART  CALL    2BH              ;WAIT FOR MESS #
4C1D B7        03670         OR      A
4C1E 28FA      03680         JR      Z,MSTART
4C20 06FE      03690         LD      B,0FEH           ;MAX OF 254 CHARS
4C22 FE31      03700         CP      31H              ;MESSAGE # 1?
4C24 280F      03710         JR      Z,M1
4C26 FE32      03720         CP      32H              ;MESSAGE # 2?
4C28 281C      03730         JR      Z,M2
4C2A FE33      03740         CP      33H              ;MESSAGE # 3?
4C2C 2829      03750         JR      Z,M3
4C2E FE34      03760         CP      34H              ;MESSAGE # 4?
4C30 2836      03770         JR      Z,M4
4C32 C3004A    03780         JP      START            ;RESTART IF NO MESS #
4C35 210051    03790 M1      LD      HL,5100H         ;M1 BUFFER
4C38 CD4000    03800         CALL    40H              ;INPUT MESSAGE
4C3B 78        03810         LD      A,B              ;GET # CHARS IN M1
4C3C 6F        03820         LD      L,A
4C3D 3C        03830         INC     A
4C3E 320250    03840         LD      (5002H),A        ;STORE IT
4C41 3600      03850         LD      (HL),0           ;LAST BYTE 0
4C43 C3004A    03860         JP      START            ;M1 ENTERED
4C46 210052    03870 M2      LD      HL,5200H         ;M2 BUFFER
4C49 CD4000    03880         CALL    40H              ;INPUT MESSAGE
4C4C 78        03890         LD      A,B              ;GET # CHARS IN M2
4C4D 6F        03900         LD      L,A
4C4E 3C        03910         INC     A
4C4F 320350    03920         LD      (5003H),A        ;STORE IT
4C52 3600      03930         LD      (HL),0
4C54 C3004A    03940         JP      START            ;M2 ENTERED
4C57 210053    03950 M3      LD      HL,5300H
4C5A CD4000    03960         CALL    40H
4C5D 78        03970         LD      A,B
4C5E 6F        03980         LD      L,A
4C5F 3C        03990         INC     A
4C60 320450    04000         LD      (5004H),A
4C63 3600      04010         LD      (HL),0
4C65 C3004A    04020         JP      START
4C68 210054    04030 M4      LD      HL,5400H
4C6B CD4000    04040         CALL    40H
4C6E 78        04050         LD      A,B
4C6F 6F        04060         LD      L,A
4C70 3C        04070         INC     A
4C71 320550    04080         LD      (5005H),A
4C74 3600      04090         LD      (HL),0
4C76 C3004A    04100         JP      START
               04110 ;
               04120 ;MESSAGE SENDING ROUTINE
4C79 C5        04130 MES1    PUSH    BC
4C7A D5        04140         PUSH    DE
4C7B 0600      04150         LD      B,0              ;FIX BC COUNTER
4C7D 3A0250    04160         LD      A,(5002H)        ;GET # OF CHARS
4C80 4F        04170         LD      C,A              ;BC=# OF CHARS
4C81 E5        04180         PUSH    HL               ;MAKE FRONT BUFF
4C82 D1        04190         POP     DE               ;THE DESTINATION
4C83 210051    04200         LD      HL,5100H         ;M1 BUFF SOURCE
4C86 C5        04210         PUSH    BC
4C87 EDB0      04220         LDIR                     ;MOVE IT
4C89 C1        04230         POP     BC               ;GET # OF CHARS
4C8A 1B        04240         DEC     DE               ;ADJUST BUFFER
4C8B D5        04250         PUSH    DE
4C8C E1        04260         POP     HL               ;NEW FRONT BUFF
4C8D E5        04270         PUSH    HL               ;SAVE IT
4C8E DD212040  04280         LD      IX,4020H         ;CURSOR
4C92 DD5E00    04290         LD      E,(IX+0)         ;IS DESTINATION
4C95 DD5601    04300         LD      D,(IX+1)
4C98 210051    04310         LD      HL,5100H         ;M1 BUFF SOURCE
4C9B 0B        04320         DEC     BC
4C9C EDB0      04330         LDIR                     ;PRINT M1
4C9E DD7300    04340         LD      (IX+0),E         ;SAVE CURSOR
4CA1 DD7201    04350         LD      (IX+1),D
```

```
4CA4 E1        04360         POP     HL
4CA5 D1        04370         POP     DE
4CA6 C1        04380         POP     BC
4CA7 C9        04390         RET
4CA8 C5        04400 MES2    PUSH    BC
4CA9 D5        04410         PUSH    DE
4CAA 0600      04420         LD      B,0
4CAC 3A0350    04430         LD      A,(5003H)
4CAF 4F        04440         LD      C,A
4CB0 E5        04450         PUSH    HL
4CB1 D1        04460         POP     DE
4CB2 210052    04470         LD      HL,5200H
  B5 C5        04480         PUSH    BC
4CB6 EDB0      04490         LDIR
4CB8 C1        04500         POP     BC
4CB9 1B        04510         DEC     DE
4CBA D5        04520         PUSH    DE
4CBB E1        04530         POP     HL
4CBC E5        04540         PUSH    HL
4CBD DD212040  04550         LD      IX,4020H
4CC1 DD5E00    04560         LD      E,(IX+0)
4CC4 DD5601    04570         LD      D,(IX+1)
4CC7 210052    04580         LD      HL,5200H
4CCA 0B        04590         DEC     BC
4CCB EDB0      04600         LDIR
4CCD DD7300    04610         LD      (IX+0),E
4CD0 DD7201    04620         LD      (IX+1),D
4CD3 E1        04630         POP     HL
4CD4 D1        04640         POP     DE
4CD5 C1        04650         POP     BC
4CD6 C9        04660         RET
4CD7 C5        04670 MES3    PUSH    BC
4CD8 D5        04680         PUSH    DE
4CD9 0600      04690         LD      B,0
4CDB 3A0450    04700         LD      A,(5004H)
4CDE 4F        04710         LD      C,A
4CDF E5        04720         PUSH    HL
4CE0 D1        04730         POP     DE
4CE1 210053    04740         LD      HL,5300H
4CE4 C5        04750         PUSH    BC
4CE5 EDB0      04760         LDIR
4CE7 C1        04770         POP     BC
4CE8 1B        04780         DEC     DE
4CE9 D5        04790         PUSH    DE
4CEA E1        04800         POP     HL
4CEB E5        04810         PUSH    HL
4CEC DD212040  04820         LD      IX,4020H
4CF0 DD5E00    04830         LD      E,(IX+0)
4CF3 DD5601    04840         LD      D,(IX+1)
4CF6 210053    04850         LD      HL,5300H
4CF9 0B        04860         DEC     BC
4CFA EDB0      04870         LDIR
4CFC DD7300    04880         LD      (IX+0),E
4CFF DD7201    04890         LD      (IX+1),D
4D02 E1        04900         POP     HL
4D03 D1        04910         POP     DE
4D04 C1        04920         POP     BC
4D05 C9        04930         RET
4D06 C5        04940 MES4    PUSH    BC
4D07 D5        04950         PUSH    DE
4D08 0600      04960         LD      B,0
4D0A 3A0550    04970         LD      A,(5005H)
4D0D 4F        04980         LD      C,A
4D0E E5        04990         PUSH    HL
4D0F D1        05000         POP     DE
4D10 210054    05010         LD      HL,5400H
4D13 C5        05020         PUSH    BC
4D14 EDB0      05030         LDIR
4D16 C1        05040         POP     BC
4D17 1B        05050         DEC     DE
4D18 D5        05060         PUSH    DE
4D19 E1        05070         POP     HL
4D1A E5        05080         PUSH    HL
4D1B DD212040  05090         LD      IX,4020H
4D1F DD5E00    05100         LD      E,(IX+0)
4D22 DD5601    05110         LD      D,(IX+1)
4D25 210054    05120         LD      HL,5400H
4D28 0B        05130         DEC     BC
4D29 EDB0      05140         LDIR
4D2B DD7300    05150         LD      (IX+0),E
4D2E DD7201    05160         LD      (IX+1),D
4D31 E1        05170         POP     HL
4D32 D1        05180         POP     DE
4D33 C1        05190         POP     BC
4D34 C9        05200         RET
4A00           05210         END     4A00H
00000 TOTAL ERRORS
```

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prints it on the CRT; at the end, the B register contains the number of characters in the message. This is saved to use when the message is called. The value is used by the LDIR routines which transfer the message to the sending buffer and to the CRT display.

I was tempted to go back and make the program more compact. However, that would make it more difficult to understand and to modify. To add more messages, you can use the ones in the program as a guide and add to the end of the program.

Interface

A schematic of a very simple circuit is presented which can be used to interface the computer with your transmitter. The tip of the cassette auxiliary plug changes voltage from 0.4 to 0.8 whenever OUT(0FFH), A with A=1 appears. This makes it possible to use a low-voltage comparator to drive the transmitter. I measured the current in this circuit at less than 10 mA for a +5-volt supply. Any supply voltage from 4 to 36 volts can be used. Be sure to pick the two resistors in the reference voltage divider so that the reference is just slightly larger than 0.4 volts. When V in is larger than this reference, the output of the comparator goes high and turns on the transistor and this will ground its output. That will key a solid-state transmitter or a relay if you need it.

Conclusion

This program has made sending CW a real pleasure for me and I know the guy on the other end appreciates the perfectly-sent code. The computer is put into service by just plugging in the cassette auxiliary plug—the one in the middle. Correspondence always a pleasure. 73.■

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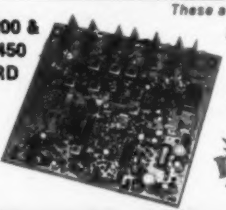

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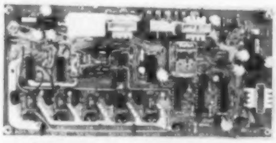
SCR450 UHF Receiver Bd. or Assy.

- Similar to SCR200, except 420-470MHz



SCAP Autopatch Board

- Provides all basic autopatch functions
- Secure 3 Digit Access; 1 Aux On-Off function, Audio AGC; Built-in timers; etc. Beautiful Audio!
- 0/1 inhibit bd. also available
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- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater
- Includes land line "answering" circuitry

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- Adjustable ID tone, speed, level, timing cycle.
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CTC100 Rptr. COR Timer/Control Bd.

- Complete solid state control for rptr. COR, "Hang" Timer, "Time-Out" Timer, TX Shutdown/Reset, etc.
- Includes Inputs & Outputs for panel controls & lamps

Repeater Tone & Control Bds.—For SCR1000/4000 & CTC100/ID250 only

TRA-1 "Courtesy Tone Beeper" Board

- Puts out a tone beep apx. 1 sec. after RX sig. drops—thus allowing time for breakers
- Resets T.O. Timer after "beep"

TMR-1 "Kerchunker Killer" or "Time Out Warning Tone" Bd.

- For **One** of above 2 functions
- "Kerchunker Killer" provides adj. delay (0-10 sec.) for *initial rptr. access*. Auto-Reset at end of QSO.
- T.O. Warning Tone provides alerting "warble tone" apx. 10 sec. before "time out."

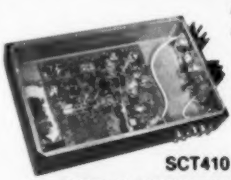
PSM-1 Repeater Power Supply Mod Kit

- For SCR-1000 or SCR-4000
- Replaces Darlington Pass Tr.—*for improved reliability*
- Includes new overvoltage "Crowbar" shutdown circuit.
- Complete kit, w/assembled PC board. $19.50 + $3.50 shipping/handling.

PRM200 Power Supply Filter Cap/Regulator/Metering Board

- As used in the SCR1000 as main part of 13.8VDC/6A Pwr. Sply.
- Includes 14,000 µF Filter Cap, Reg. IC and Driver Trans., V/I Meter shunts and cal pots.
- Requires Xfmr., Br. Rect., Pass Tr./Heat Sink, (Optional Meter), for complete supply.

10M ALSO AVAILABLE See Aug. 73 Ad.



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SCT110 Transmitter Assembly

- *SCT110 mounted in shielded housing.*
- Same as used on SCR1000.
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SCT410 UHF Transmitter Bd. or Assy.

- *Similar to SCT110, 10 Wts. nom.*
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- For SCT110 or SCT410 Exciters
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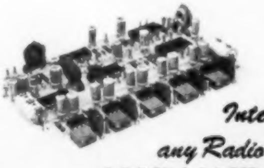

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CW — The Air Force Way

Staff Sgt. Ed Metzler
Keesler Technical Training Center
Keesler AFB MS 39534

Thousands of hams use Morse code every day to make contact with friends and acquaintances around the world, but Morse systems operators in the Air Force use the international code for a more serious reason.

"The people we train here will go to various installations around the world, mainly to assist in communications-gathering operations," said Major Emmitt D. Lane, chief of the Systems Operations Branch at Keesler Technical Training Center, Keesler Air Force Base, Mississippi. "Our operators monitor and transcribe radio communications at many locations, providing the Air Force with a secure communications security program."

It's a critical job in today's complex, ever-changing world and it's the job of the Systems Operations Branch to see that the Air Force operators are highly qualified for their responsibilities. The branch is under the command of the 3300th Technical Training Wing, the Air Force's electronics training center. At Keesler, airmen selected for Morse systems operator duty undergo an intensive 21-week course of instruction that is divided into three blocks of instruction. Students must be able to transcribe 20 groups of code per minute to graduate from the course, although the average graduate does about 25 five-character groups a minute.

To achieve this end, students spend approximately six hours a day, five days a week in the classroom. In block I, the students are introduced to international Morse code and typing.

"We teach by the reflex method," said Cicero Rhodes, an instructor supervisor who spent more than 20 years in the field before retiring from active duty. "When the students hear the dahs and dits on their headphones, they automatically type the letter or number. After a lot of drill and repetition, it becomes second nature to them."

"Students learn the 31 characters during their first week of school," said Technical Sgt. Robert C. Templin, block I instructor.

Block I students are drilled on the basic characters of international Morse code.

A block I instructor uses the Vibroflex key to drill students before hooking into the distribution center.

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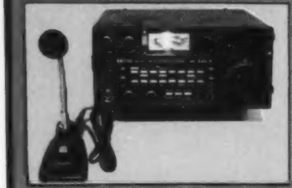

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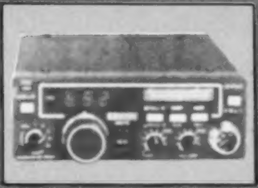

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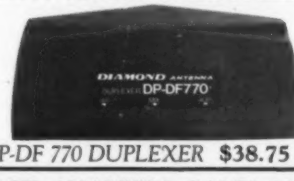

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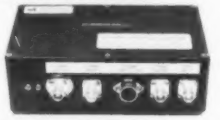

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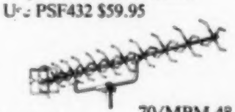

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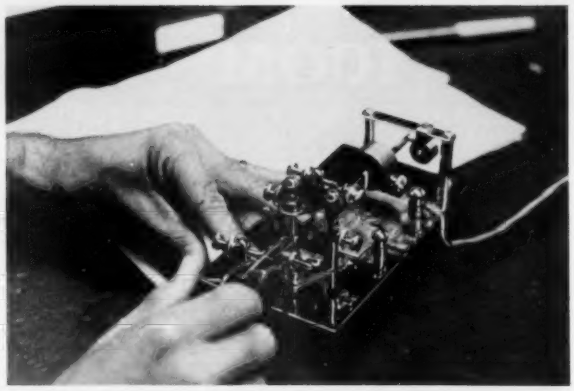
A student in block III scans radio frequencies for message traffic.



A Vibroflex semi-automatic key used by instructors to drill students on individual characters.

"We combine learning the character sounds and typing. On day one, they learn the first finger characters as they appear on a standard typewriter, day two we teach second finger, and so on. By the end of the block, students are expected to copy 12 groups per minute."

Templin added that students who show effort, but have some difficulty learning the code, are set back in the course to bring their proficiency up. About 30 percent of the students, for one reason or another, do not graduate.

After learning the characters, the ditty-boppers, as they call themselves, work on their copy speed. As with learning the characters, this is done gradually.

"We start the classes at four groups per minute, then work up to 12," said Templin. "It's a matter of repetition and memorization." Codes are transmitted to the various classrooms by a closed-circuit system from a single distribution center. The center can send code in separate speeds to individual students or send uniform code to an entire class. The code tapes are made by the school staff, and unlike other branches of the military, are done by hand rather than computer. According to Rhodes, this personalized system allows for more individual attention.

In the basic block, students spend three to four hours a day copying messages from the distribution center. Some time is also spent in character drills. Using the Vibroflex semi-automatic key, an instructor can drill the 20 or so students in his class on particular problem characters or patterns before hooking up to the center.

In blocks II and III, students continue to increase their copying speed while learning other facets of the career field. In the intermediate block, students are taught radio wave and antenna theory and how to operate receivers. At the end of this block, students are able to copy 16 groups of code per minute. The last block deals with complex receiving using more than one receiver and locating copy on different frequencies. By the end of block III, students are expected to copy 20 groups per minute.

"It's a very demanding course," said Sergeant Templin. "The material is very abstract. If someone is having trouble with a particular character, you can't just say, 'OK, turn to page 14 in the text and read all about the letter C.' It requires a person who isn't nervous or high strung, who won't get upset about every mistake he or she makes."

"Like anything else, it takes a lot of practice and patience," Rhodes emphasized. "How many tennis balls do you think you'd hit perfecting your backhand? Our methods aren't hit and miss, by any means, but I would say that repetition is the keystone to learning Morse code."

"I'm confident our methods work and that we are turning out very capable people into the field," said Major Lane. "We have to; our graduates fill some of the most critical positions in the Air Force."■

An instructor prepares a tape that will be used to broadcast from the distribution center.

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DK200—Same as DK210 without L.E.D. speedmeter

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CNW518/CNW418
Manual Antenna Tuners

Maximize station performance with high quality Daiwa tuners.

CNW518—**Frequency range:** Amateur bands 3.5 - 30 MHz. Including new WARC bands • **Power Rating:** SSB-2.5 kW PEP, CW-1 kW (50% duty) • Two antenna outputs for unbalanced lines • **Dimensions:** 225W x 90H x 275D m/m

CNW418 (not shown)—Same specifications as CNW518 except: **Power Rating:** SSB-500 watts PEP, CW-200 watts • **Dimensions:** 225W x 90H x 245D m/m

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CN540—**Frequency:** 50 - 150 MHz. • **Power rating:** 200 watts max. • **Sensitivity:** 4 watts minimum • **Accuracy:** Same as CN520 • **Dimensions:** Same as CN520

CN550—**Frequency:** 144 - 250 MHz • **Power ratings:** 200 watts max. • **Sensitivity:** 4 watts minimum • **Accuracy:** Same as CN520 • **Dimensions:** Same as CN520

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SOCIAL EVENTS

MILWAUKEE WI
JUL 8-11

The YL International Single Sidebander's (YLISSB) 1982 Convention will be held on July 8-11, 1982, in Milwaukee WI. Activities will include the DX Roundup, the Systems Awards Banquet on Saturday night, and a major door prize of an Icom IC-2AT. Jean Chittenden WA2BGE will tell about her recent China trip. Pre-convention activities will begin July 5, 1982, with golfing, fishing, and side trips planned. Detailed information may be obtained by sending an SASE (business size) to Sus Musachi KB9OC, PO Box 18123, Milwaukee WI 53218.

STATE COLLEGE PA
JUL 10

The Nittany Amateur Radio Club Ham Festival will be held on July 10, 1982, from 8:00 am to 4:00 pm, at the HRB-Singer picnic grounds, Science Park Road (between US 322 West and Rte. 26 East), State College PA. Talk-in on 146.16/.76, 146.25/.85, and 146.52. Features will include a flea market, technical sessions, numerous prizes and contests, and refreshments. Tickets are $3.00; tailgating and tables are $5.00. For more information, contact Richard L. Sine KB3WN 1600 E. Branch Road, State College PA 16801.

OAK CREEK WI
JULY 10

The South Milwaukee Amateur Radio Club will hold its annual swapfest on Saturday, July 10, 1982, from 7:00 am to 5:00 pm at the American Legion Post 434, 9327 South Shepard Avenue, Oak Creek WI. Admission is $2.00 and includes a happy hour with free beverages. Prizes include a $100 first prize and a $50 second prize plus a variety of other prizes to be awarded during the day. Parking, a picnic area, hot and cold sandwiches, liquid refreshments, and overnight camping will be available. Talk-in on 146.94. More details, including a map, may be obtained from the South Milwaukee Amateur Radio Club, PO Box 102, South Milwaukee WI 53172.

MILTON ONT CAN
JUL 10

The Burlington Amateur Radio Club will hold the 8th annual Ontario Hamfest on Saturday, July 10, 1982, at the Milton Fairgrounds, Milton, Ontario. Admission is $3.00 per person or $2.00 for pre-registration. There will be a flea market, displays, an auction, contests, and prizes. Camping will be available and grounds will open Friday night for early campers. For pre-registration, contact Mike Cobb VE3MWR, PO Box 836, Burlington L7R 3Y7, Canada.

BOISSEVAIN MAN CAN
JUL 10-11

The 19th annual International Hamfest will be held on July 10-11, 1982, on the Canadian side of the International Peace Gardens between Dunseith ND and Boissevain MAN in the Canadian Pavilion. Activities will include transmitter hunts, mobile judging, CW and QLF contests, seminars for OMs and YLs, flea markets, a ham auction, a Saturday night dance, a Sunday morning breakfast, and lots of great prizes. For more information, contact Bernie Arcand WD0MD, PO Box 53, Epping ND 58843, or William M. Shryock, Jr. WD0GRC, 322 East 4th Street, Williston ND 58801.

RAPID CITY SD
JUL 10-11

The Black Hills ARC will hold the annual South Dakota Hamfest on July 10-11, 1982, at the Surbeck Center, SD School of Mines and Technology, Rapid City SD. Pre-registration is $7.00; registration at the door is $8.00. There will be a prize drawing for pre-registrants, forums, contests, a picnic, and prizes. Tables are free for the flea market. Talk-in on .34/.94 (W0BLK). For further information, write Black Hills ARC, c/o Rudy WB0PWA, 4822 Capitol, Rapid City SD 57701.

MAPLE RIDGE BC CAN
JUL 10-11

The Maple Ridge ARC will hold its Hamfest '82 on July 10-11, 1982, at the Maple Ridge Fairgrounds, located 30 miles east of Vancouver, Maple Ridge BC. Registration for hams is $5.00; for non-hams over 12 years old, $2.00. There will be food, prizes, a swap & shop, displays, a bunny hunt, ladies' and children's programs, and a main prize drawing for a Kenwood TR-2500. Camper spaces will be available (some with electrical hookups). Talk-in on 146.20/.80. For more information and registration, contact Maple Ridge ARC, Box 292, Maple Ridge BC V2X 7G2.

ALEXANDER NY
JUL 11

The Genesee Radio Amateurs, Inc., will hold the second annual ARRL-approved Batavia Hamfest on Sunday, July 11, 1982, from 7:00 am to 5:00 pm at the Alexander Firemen's Grounds, Rte. 98 (nine miles south of Batavia), Alexander NY. Registration is $2.00 in advance, $3.00 at the gate, and $1.00 for the flea market. There will be many prizes, a large exhibit area, OM and YL programs, contests, plenty of food, overnight camping, and a boat anchor auction at 3:00 pm. Talk-in on 4.71/5.31 (W2RCX) or .52. For advance tickets, make checks payable to Batavia Hamfest, c/o Gram, Inc., Box 572, Batavia NY 14020.

MCKEESPORT PA
JUL 11

The Two Rivers Amateur Radio Club, Inc., will hold its annual hamfest on July 11, 1982, from 9:00 am to 5:00 pm, at the McKeesport Campus of Penn State University, McKeesport PA. There will be forums, prizes, food, an outdoor flea market, and indoor setups. Talk-in on 146.22/.82. For more information, telephone (412)-464-0550.

INDIANAPOLIS IN
JULY 11

The Indiana State Amateur Radio Convention, in conjunction with the Indianapolis Hamfest and Computer Show, will be held on Sunday, July 11, 1982, at the Marion County Fairgrounds at the southeastern intersection of I-74 and I-465. Gate tickets are $4.00 and entitle you to all activities, including the major prize drawing and hourly prizes. There will be inside and outside flea markets, a separate computer show and flea market, a commercial vendors' display area, technical forums, club activities, and ladies' programs. There will be setups after 12:00 noon on Saturday, July 10th. Security will be provided Saturday night and Sunday, and camper hookup facilities will be available on the grounds. For further information, contact Indianapolis Hamfest, Box 11086, Indianapolis IN 46201.

MANCHESTER NH
JUL 17

The New Hampshire FM Association will hold an electronics flea market on Saturday, July 17, 1982, at the Manchester Municipal Airport, Manchester NH, beginning at 9:00 am. General admission is $1.00 per person; sellers, $5.00. Sellers should tailgate or bring their own tables. Commercial displays are welcome. Refreshments will be available and door prizes will be awarded. Talk-in on 146.52 FM and 124.9 AM. For further information, contact Dick DesRosiers W1KGZ at (603)-668-8880, or Doug Aiken K1WPM, 30 Meadowglen Drive, Manchester NH 03103, (603)-622-0831.

SHEBOYGAN WI
JUL 17

The third annual Sheboygan County Amateur Radio Club Lakeshore Swapfest and Brat Fry will be held on July 17, 1982, from 8:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. There will be a public auction and prizes. Tables are free and camping will be available at Terry Andre State Park. For a flyer and additional information, write PO Box 895, Sheboygan WI 53081, or call (414)-457-3203.

HARBOR SPRINGS MI
JUL 17

The Straits Area Amateur Radio Club will hold its annual hamfest on July 17, 1982, from 9:00 am to 4:00 pm at the Harbor Springs High School, Harbor Springs MI. Donations are $2.00 at the door and table space is $2.50. Doors will be open at 8:00 am for setups. Lunch will be served from 11:00 am to 1:00 pm and refreshments will be available during the day. There will be one main door prize and smaller prizes will be awarded hourly. The school parking lot is free for self-contained RVs to use for an overnight stay and many places of interest to YLs are available nearby. Talk-in on .52/.52 and 146.07/.67. For more details, contact Mr. Bernie Slotnick KB8RE, 630 Ann Street, Harbor Springs MI 49740, or call (616)-526-5614.

EUGENE OR
JUL 17–18

The Lane County Ham Fair will be held on July 17–18, 1982, at the Oregon National Guard Armory, 2515 Centennial, Eugene OR. Tickets are $4.00 each and entitle the holder to one extra drawing ticket free if purchased before July 1st. Doors will open at 8:00 am Saturday and Sunday. Features will include a swap and shop at $5.00 a table, a 2-meter bunny hunt, women's activities, a children's corner, computer demos, technical seminars, QCWA, and a grand prize of an Icom 730 low-band mobile rig. There will be an all-day snack bar, free parking for RVs (no hookups), and a Saturday potluck supper at 6:00 pm. Talk-in on .52/.52, 146.28/.88, 147.86/.26, and 3.910 HF. For advance tickets, send an SASE to Eunice Brown WA7MOK, 2456 Corral Court, Springfield OR 97477, or phone (503)-747-7939.

BOWLING GREEN OH
JUL 18

The 17th annual Wood County Ham-A-Rama will be held on Sunday, July 18, 1982, at the Wood County Fairgrounds, Bowling Green OH. Gates will open at 10 am, with free admission and parking. There will be drawings for prizes: tickets are $1.50 in advance and $2.00 at the gate. Trunk sales space and food will be available. Advance table rentals are $3.00 to dealers only. Saturday setup available until 8:00 pm. K8TIH talk-in on .52. For more info or dealer rentals, send an SASE to Wood County ARC, c/o S. Irons, PO Box 73, Luckey OH 43443.

WASHINGTON MO
JUL 18

The Zero Beaters Amateur Radio Club will hold its hamfest on Sunday, July 18, 1982, at the Washington Fairgrounds, Washington MO. Talk-in on 147.84/.24. For more information, contact Rich Noelke WA0NUI, Rte. 3, 10 Richard Drive, Washington MO 63090.

CANTON OH
JUL 18

The Tusco Radio Club (W8ZX) and the Canton Amateur Radio Club (W8AL) will hold the 8th annual Hall of Fame Hamfest on July 18, 1982, at the Nimishillen Grange, 6461 Easton Street, Louisville OH. Admission is $2.50 in advance, $3.00 at the gate, and children under 16 will be admitted free. The flea market will open at 9:00 am and activities will include awards, forums, dealers, and XYL programs. Talk-in on 146.19/.79, 146.52/.52, and 147.72/.12. For reservations and/or information, contact Butch Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH 44601, or phone (216)-821-8794.

LA PORTE IN
JUL 18

The LaPorte County Summer Hamfest will be held on Sunday, July 18, 1982, at the County Fairgrounds, LaPorte IN. Good food, cold drinks, and an indoor selling area will be available. For reservations and more information, write PO Box 30, LaPorte IN 46350.

GRAND RAPIDS MN
JUL 18

The Range Wide Hamfest will be held on July 18, 1982, from 10:00 am to 4:00 pm at Gunn Park, Highway 38, 6 miles north of Grand Rapids MN. Admission and tables are free. Bring the family for a picnic, games, prizes, and fun. Parking and campgrounds will be available. Talk-in on 146.28/.88 and .52. For more information, write Bob WD0AAF, 736 Crystal Springs Road, Grand Rapids MN 55744, or call (218)-326-2268 (evenings).

OKANOGAN WA
JUL 24-25

The Okanogan Valley International Hamfest will be held July 24-25, 1982, at the Okanogan County Fairgrounds, Okanogan WA. Registration is $3.00 for hams and $2.00 for non-hams. Activities will include bingo, a cake walk, a 2-meter bunny hunt, and a Sunday potluck dinner, followed by a drawing for prizes. Talk-in on 146.97. Hookups will be available for those who need them, and motels and restaurants are close by. For more information, contact Frank Bigelow WA7ZEV or Buck Buchanon W7GSN.

OKLAHOMA CITY OK
JUL 23-25

The Central Oklahoma Radio Amateurs, Inc. will hold the Oklahoma State ARRL Convention at "Ham Holiday '82" on July 23-25, 1982, at the Myriad Convention Center, Oklahoma City OK. Pre-registration is $6.00 and includes free flea-market tables. The pre-registration award is a Radio

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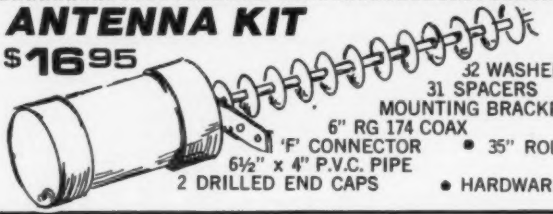

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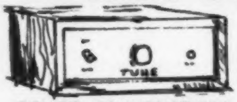

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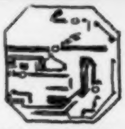

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WELLINGTON OH
JUL 24

The Northern Ohio Amateur Radio Society will hold its annual ARRL NOARSfest on Saturday, July 24, 1982, at the Lorain County Fairgrounds, 18 miles south of Lorain, one mile west of Route 58 on Route 18, Wellington OH. Admission tickets are $2.50 in advance, $3.00 at the gate, and are good for all prize drawings. Children under 12 will be admitted free. Admission tickets may be ordered from NOARSfest, PO Box 354, Lorain OH 44052. There will be over 100 prizes, including an Icom 730 and power supply, an Ameritron, Inc., A1-80 linear amplifier, and an Icom IC-2AT. Featured will be a large flea market with parking spaces at $1.00 each, free parking, an indoor exhibit hall, refreshments, and free overnight camping (without hookups) on Friday. Indoor exhibit spaces with 8-foot tables are available at $8.00 each. Send a check for advance registration to Ernie or Pat Jackson, 201 Park Avenue, Elyria OH 44035. Talk-in on 146.52/.52 and 146.10/.70.

POUGHKEEPSIE NY
JUL 24

The Mt. Beacon Amateur Radio Club will hold its annual hamfest on July 24, 1982, beginning at 8:00 am, at the Arlington Senior High School, Poughkeepsie NY. Admission is $2.00 (XYLs and children admitted free), tailgating space is $3.00 (includes 1 free admission), and a table space is $4.00 (includes 1 free table and admission). There will be the free flea market tables indoors, parking door prizes, an auction starting at 2:00 pm, and hot food and beverages. Talk-in on 146.37/.97 and 146.52. For additional information, advance tickets, or registration, send an SASE to Walt Cotter WA2ZCN, North Hillside Lake Road, Wappingers Falls NY 12590, or phone (914)-226-6636.

GREENVILLE OH
JUL 24-25

The Treaty City Amateur Radio Association will be operating special event station W8UMD from the site of the Annie Oakley Days celebration, from 1600Z July 24 until 1600Z July 25. They will operate up 10 kHz from the bottom of the General band on 40 and 20 meters and will venture into the 40-meter Novice band occasionally. Send a business size SASE and QSL cards for a special certificate to TCARA, Box 91, Greenville OH 45331.

WEST FRIENDSHIP MD
JUL 25

The Baltimore Radio Amateur Television Society (BRATS) will hold its annual BRATS Maryland Hamfest on Sunday, July 25, 1982, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to Interstate 70, about 15 miles west of Baltimore, in West Friendship MD. Indoor tables with ac power are $15.00 each; without ac power, $10.00 each. Indoor tailgating is $5.00 per space; outdoor tailgating is $3.00 per space. Overnight RV hookups will be available. For more information and reservations, write to BRATS, PO Box 5915, Baltimore MD 21208.

CENTREVILLE MI
JUL 25

The Amateur Radio Public Service Association of St. Joseph County MI will hold its 4th annual swap and shop on July 25, 1982, at the St. Joseph County Fairgrounds, Centreville MI. Doors open at 8:00 am. Tickets are $2.00 in advance and $3.00 at the gate. Indoor tables are $2.00. Trunk sales are free. Camping is available Saturday night only for $6.00. Talk-in on 146.52. For more information, contact Dennis Cutler N8DDU, 3051 Z Avenue, Vickesburg MI 49097.

WHEELING WV
JUL 25

The Triple States Radio Amateur Club will hold its 4th annual hamfest on Sunday, July 25, 1982, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $2.00 (50/50); children under 12 will be admitted free. There will be major prizes plus door prizes every 15 minutes; a 15-minute auction every hour on the hour; free parking for 1,000 cars; refreshments; ARRL/SWOT/TSRAC booths; indoor dealer displays; and a flea market. There will be setups the night before or at 7:00 am Sunday morning. Talk-in on 146.31/.91 and 146.52. For advance dealer registration, electrical outlet and table requests, submission of free ads for the club's hamfest issue, and more information, contact TSRAC, Box 240, RD 2, Adena OH 43901.

NEW ORLEANS LA
JUL 25

The Delgado Community College Amateur Radio Club will hold its annual swapfest on Sunday, July 25, 1982, from 8:00 am to 4:00 pm, at the Peristyle in City Park, New Orleans LA. There is no charge for setting up, but those participating must bring their own tables. Admission is free. There will be plenty of free parking, and food and drinks will be available nearby. Talk-in on 146.67. For further information, contact Jim Wolfe, Club President, Delgado Amateur Radio Club, Delgado Community College, 615

Continued on page 150

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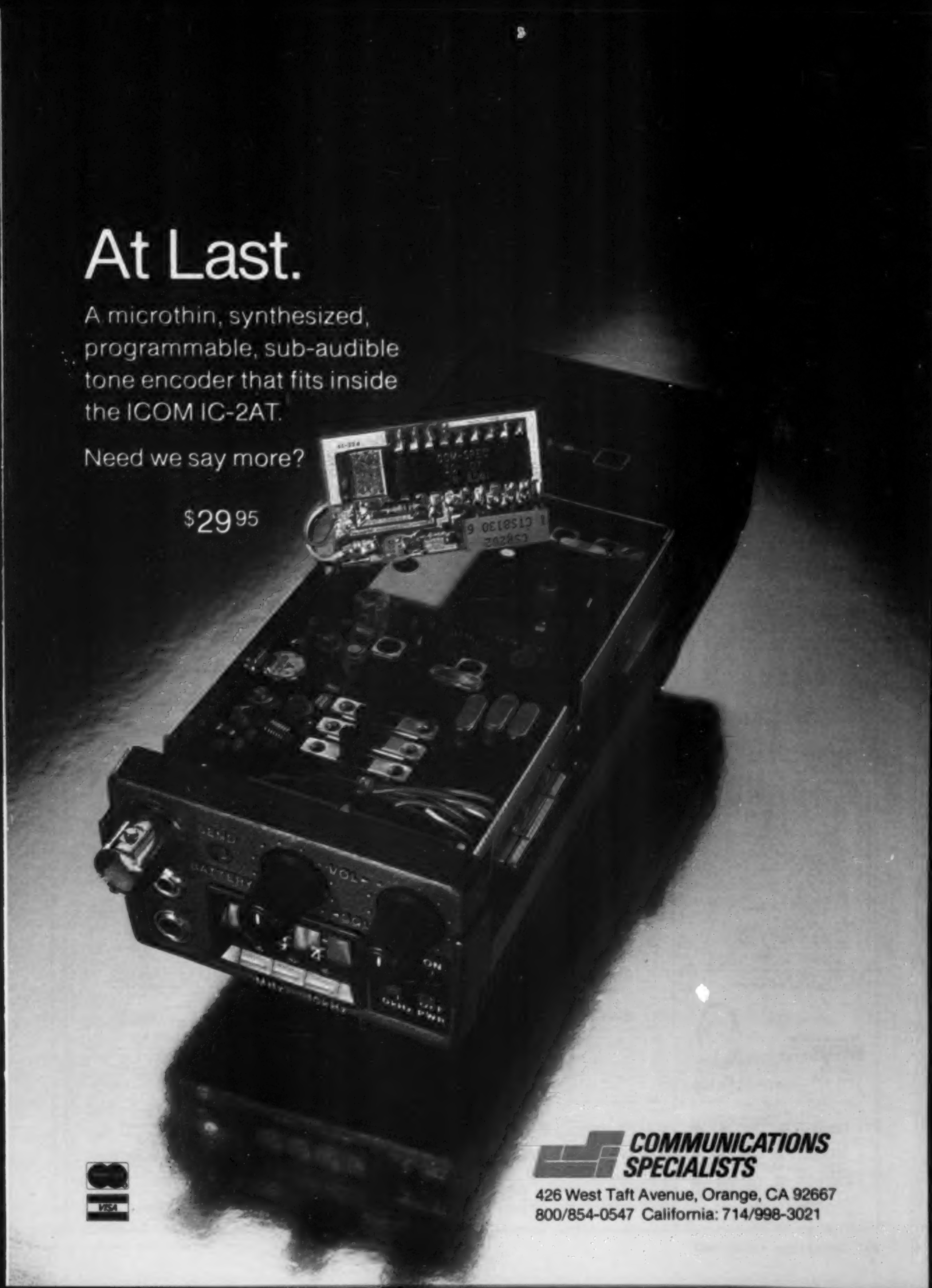

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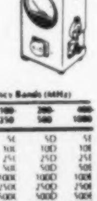

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5 watts		5A	5C	5D	5E
10 watts		10A	10C	10D	10E
25 watts		25A	25C	25D	25E
50 watts	50H	50A	50C	50D	50E
100 watts	100H	100A	100C	100D	100E
250 watts	250H	250A	250C	250D	250E
500 watts	500H	500A	500C	500D	500E
1000 watts	1000H	1000A	1000C	1000D	1000E
2500 watts	2500H				
5000 watts	5000H				

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HALF-SIZE FULL PERFORMANCE
Multi-Band HF Communications Antennas

MOR-GAIN HD Dipoles

- One half the length of conventional half-wave dipoles
- Multi-band, Multi-frequency
- Maximum efficiency - no traps, loading coils, or stubs
- Fully assembled and pre-tuned - no measuring, no cutting
- All weather rated - 1 KW AM, 2.5 KW CW or PEP SSB
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TEL: (603) 883-5005

TR-2500

BIG performance, small size, smaller price!

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 memories, lithium battery memory back-up, memory scan, programmable automatic band-scan, Hi/Lo power switch and built-in sub-tone encoder.

KENWOOD 2m FM TRANSCEIVER
TR-2500

TR-2500 FEATURES:

- Extremely compact and light weight 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches), 540 g, (1.2 lbs) with NiCd pack.
- LCD digital frequency readout.
- Ten memories includes "MO" memory for non-standard split repeaters.
- Lithium battery memory back-up, built-in, (est. 5 year life).
- Memory scan.
- Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5 kHz and larger (5, 10, 15, 20, 30 kHz . . . etc) to be programmed.

CONVENIENT TOP CONTROLS

TX OFFSET — REV
NORM
SP
MIC
ON
LOW
TONE
HI
SQUELCH
OFF
POWER/VOL

- UP/DOWN manual scan.
- Repeater reverse operation.
- 2.5 W or 300 mW RF output. (HI/LOW power switch).
- Built-in tunable (with variable resistor) sub-tone encoder.
- Built-in 16-key autopatch.
- Slide-lock battery pack.
- Keyboard frequency selection.
- Covers 143.900 to 148.995 MHz in 5 kHz steps.
- Optional power source, MS-1 mobile or ST-2 AC charger/power supply allows operation while charging. (Automatic drop-in connections.)
- High impact plastic case.
- Battery status indicator.
- Two lock switches for keyboard and transmit.

Standard accessories:

- Flexible rubberized antenna with BNC connector.
- 400 mAH heavy-duty Ni-Cd battery pack.
- AC Charger.

Optional accessories:

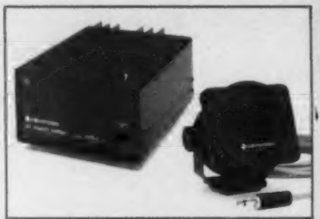
- VB-2530 25 W RF Power amp, BNC-BNC cables, and mounting bracket, supplied.
- MS-1 13.8 VDC mobile stand/charger/power supply.

Optional accessories:

- ST-2 Base station power supply and quick charger (approx 1 hr.)
- TU-1 Programmable "DIP switch" (CTCSS) encoder.
- SMC-25 Speaker microphone.
- LH-2 Deluxe leather case.
- PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy-duty.
- BT-1 Battery case for AA manganese or alkaline cells.
- BH-2 Belt hook.
- WS-1 Wrist strap.
- EP-1 Earphone.

NEW

KENWOOD 2m ALL MODE TRANSCEIVER
MEMORY
RF GAIN
RIT
MODE
POWER/VOL
SQUELCH
PUSH ON
REV
DS
SCAN
HOLD
TONE
MIC
TR-9130



Optional accessories:

- KPS-7 DC power supply for TR-9130 base station operation. 7 A intermittent, 6 A continuous, protection circuit built-in.
- SP-40 compact mobile speaker. Only 2-11/16 W x 2-1/2 H x 2-1/8 D (inches). Handles 3 watts of audio.
- TK-1 AC adapter for memory back-up (not shown).

TR-9130

All mode (FM/SSB/CW) 25 watts, plus...!!!

The TR-9130 is a powerful, yet compact, 25 watt FM/USB/LSB/CW transceiver, featuring six memories, memory scan, memory back-up capability, automatic band scan, all-mode squelch, and CW semi break-in. Available with a 16-key autopatch UP/DOWN microphone (MC-46), or a basic UP/DOWN microphone.

TR-9130 FEATURES:

- 25 Watts RF output on all modes, (FM/SSB/CW).
- FM/USB/LSB/CW all mode. The mode switch, with the digital step (DS) switch, determines the size (100 Hz, 1 kHz, 5 kHz, 10 kHz) of the tuning step.
- Six memories. On FM, memories 1-5 for simplex or ±600 kHz offset, using OFFSET switch, Memory 6 for non-standard offset. All six memories may be simplex, any mode.
- Memory scan. Scans memories in which data is stored.
- Internal battery memory back-up, using 9 V Ni-Cd battery, (not KENWOOD supplied). Memories are retained approx. 24 hours, adequate for the typical move from base to mobile. External back-up terminal on the rear.
- Automatic band scan. Scans within whole 1 MHz segments (ie., 144.0-144.999 MHz).
- Dual digital VFO's.
- Transmit frequency tuning while transmitting, for OSCAR operations.
- Squelch circuit, all modes (FM/SSB/CW).
- Repeater reverse switch.
- Tone switch.
- CW semi break-in circuit with sidetone.
- Digital display with green LED's.
- Compact size and lightweight. 170 (6-11/16) W x 68 (2-11/16) H x 241 (9-1/2) D mm (inch). 2.4 kg (5.3 lbs.) weight.
- Covers 143.9 to 148.9999 MHz.
- HI/LOW power switch. 25 or 5 watts on FM or CW.
- Transmit offset switch.
- High performance noise blanker.
- RF gain control. • RIT circuit.

KENWOOD

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NB
PROC
LOAD
PLATE
DRIVE
METER
AGC
RIT / XIT
BAND
AF RF
PHONES
MODE
MIC CAR
FIX
RIT
XIT
NOTCH
IF SHIFT NOTCH
VBT TONE
HEATER
POWER
NARROW
NORMAL
KENWOOD TS-830S
HF SSB TRANSCEIVER

TS-830S

"Top-notch"...VBT, notch, IF shift, wide dynamic range

The TS-830S has every conceivable operating feature built-in for 160-10 meters (including the three new bands). It combines a high dynamic range with variable bandwidth tuning (VBT), IF shift, and an IF notch filter, as well as very sharp filters in the 455-kHz second IF.

TS-830S FEATURES:

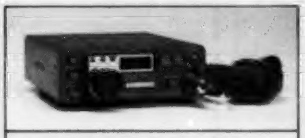
- LSB, USB, and CW on 160-10 meters, including the new 10, 18, and 24-MHz bands. Receives WWV on 10 MHz.
- Wide receiver dynamic range. Junction FETs in the balanced mixer, MOSFET RF amplifier at low level, and dual resonator for each band.
- Variable bandwidth tuning (VBT). Varies IF filter passband width.
- Notch filter high-Q active circuit in 455-kHz second IF.
- IF shift (passband tuning).
- Noise-blanker threshold level control.
- Built-in digital display, (fluorescent tube), with analog dial.
- 6146B final with RF negative feedback. Runs 220 W PEP (SSB)/180 W DC (CW) input on all bands.
- Built-in RF speech processor.
- Narrow/wide filter selection on CW.
- SSB monitor circuit.
- RIT and XIT (transmitter incremental tuning).

Optional accessories:

- SP-230 external speaker.
- VFO-230 external digital VFO with five memories, digital display.
- VFO-240 external analog VFO.
- AT-230 antenna tuner.
- YG-455C (500 Hz) or YG-455CN (250 Hz) CW filter for 455 kHz IF.
- YK-88C (500 Hz) or YK-88CN (270 Hz) CW filter for 8.83 MHz IF.
- KB-1 deluxe heavyweight knob.

NEW

14.215.0
KENWOOD
SEND
MODE
CW
SSB
REV
REC
PHONES
PROC
VOX
ALC
FIX
MIC
MIC CAR
AF GAIN RF GAIN
RIT IF SHIFT
BAND
POWER
RIT
NAR
RF ATT
NB



Optional DFC-230 Digital Frequency Controller
Frequency control in 20-Hz steps with UP/DOWN microphone (supplied with DFC-230). Four memories and digital display. (Also operates with TS-120S, TS530S, and TS-830S.)

TS-130SE

"Small talk"...IF shift, Processor, N/W switch, affordable.

A compact, all solid-state HF SSB/CW transceiver for mobile or fixed base station, covering 3.5 to 29.7 MHz.

TS-130SE FEATURES:

- 80-10 meters including the new 10, 18, and 24 MHz bands. Receives WWV on 10 MHz.
- TS-130SE runs 200 W PEP/160 W DC input on 80-15 meters, 160 W PEP/140 W DC on 12 and 10 meters. TS-130V version at 25 W PEP/20 W DC, all bands, also available.
- Digital display, built-in.
- IF shift circuit.
- Speech Processor, built in.
- Narrow/wide filter selection on CW and SSB with optional filters.
- Automatic SSB mode selection (LSB on 40 meters and below, USB on 30 meters and up). SSB reverse switch provided.
- RF attenuator, built-in.
- Final amplifier protection circuit assures maximum reliability. Output power is reduced if abnormal operating conditions occur. For very severe operations, optional cooling fan, FA-4, is available. TS-130S, with FA-4 installed, also available.
- Effective noise blanker.
- Dimensions: 3-3/4 H x 9-1/2 W x 11-9/16 D (inches). Weight: 12.3 lbs.
- Other features: VOX, CW semi break-in with sidetone, one fixed channel, and 25 kHz marker.

Optional accessories:

- PS-30 matching power supply (TS-130SE).
- KPS-21 power supply (TS-130SE).
- PS-20 power supply (TS-130V).
- SP-120 external speaker.
- VFO-120 remote VFO.
- FA-4 fan unit (TS-130SE).
- YK-88C (500 Hz) and YK-88CN (270 Hz) CW filters.
- YK-88SN (1.8 kHz) narrow SSB filter.
- AT-130 antenna tuner.
- MB-100 mobile mounting bracket.

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TRIO-KENWOOD COMMUNICATIONS
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RADIO BOOKSHOP

Think Summer,

BEAM ANTENNA
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Practical ANTENNAS for the Radio Amateur
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Think Antennas

VHF ANTENNA HANDBOOK—The new *VHF Antenna Handbook* details the theory, design, and construction of hundreds of different VHF and UHF antennas . . . a practical book written for the average amateur who takes joy in building, not full of complex formulas for the design engineer. Packed with fabulous antenna projects you can build. BK7368 $5.95.*

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73 DIPOLE AND LONG-WIRE ANTENNAS—by Edward M. Noll W3FQJ. This is the first collection of virtually every type of wire antenna used by amateurs. Includes dimensions, configurations, and detailed construction data for 73 different antenna types. Appendices describe the construction of noise bridges, line tuners, and data on measuring resonant frequency, velocity factor, and swr. BK1016 $5.50.*

ALL ABOUT CUBICAL QUAD ANTENNAS (2nd edition)—BK1196—The "Classic" on Quad design, theory, construction, and operation. New 2nd edition contains new feed and matching systems and new data. $5.95

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SIMPLE, LOW-COST WIRE ANTENNAS FOR RADIO AMATEURS—BK1200—All new data and everything you want to know about low-cost, multi-band antennas, inexpensive beams, "invisible" antennas for hams in "tough" locations. $6.95*

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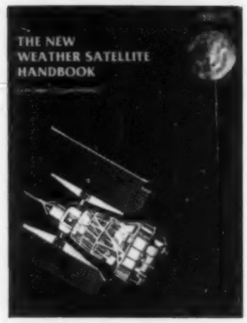
THE NEW WEATHER SATELLITE HANDBOOK



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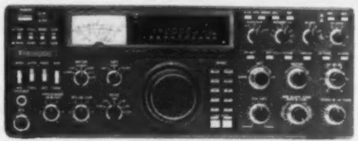
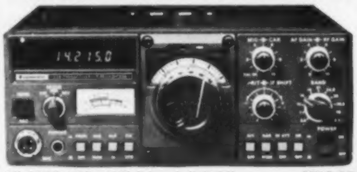
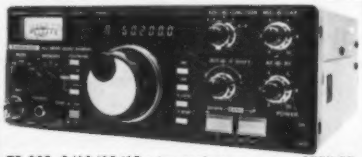


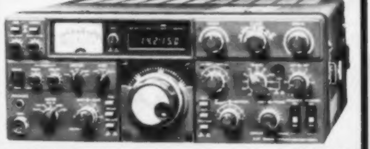
TS-930S 9-band Xcvr/.15 Mhz Rcvr	$1599.00
AT-930 Automatic antenna tuner	199.95
TS-930S w/AT-930 auto antenna tuner	1799.00
SP-930 External spkr w/audio filters	79.95
YK-88C-1 500 Hz CW filter (1st IF)	69.95
YK-88A-1 6 KHz AM filter (1st IF)	59.95
YG-455C-1 500 Hz CW filter (2nd IF)	99.95
YK-455CN-1 250 Hz CW filter (2nd IF)	119.95



TS-130S 200w PEP 8-band digital Xcvr	$719.95
TS-130SE Same as TS-130S, less fan	699.95
TS-130V 25w PEP 8-band digital Xcvr	599.95
PS-30 20A power supply for TS-130S/SE	144.95
PS-20 4.5A power supply for TS-130V	77.95
DFC-230 Digital freq controller w/mic	289.95
SP-40 Compact mobile speaker	25.95
SP-120 External speaker	41.00
VFO-230 Digital remote VFO	309.95
VFO-120 Analog remote VFO	164.95
YK-88C/YK-88CW 500 Hz CW filter	62.95
YK-88CN 270 Hz CW filter	62.95
YK-88SN 1.8 KHz SSB filter	62.95
AT-130 8-band antenna tuner	144.95
MB-100 Mobile mount	29.95
MC-30S Lo-Z dynamic mobile mic	29.95
TS-530S 9-band digital Xcvr	$739.95
DFC-230 Digital freq controller w/mic	289.95
SP-230 External spkr w/audio filters	71.95
VFO-230 Digital remote VFO	309.95
VFO-240 Analog remote VFO	169.95
YK-88C/YK-88CW 500 Hz CW filter	62.95
YK-88CN 270 Hz CW filter	62.95
YK-88SN 1.8 KHz SSB filter	62.95
AT-230 9-band tuner/SWR, pwr meter	194.95



TS-660 6/10/12/15m transceiver	$699.95
PS-20 4.5A power supply	77.95
SP-120 External speaker	41.00
VOX-4 VOX unit/speech processor	54.95
YK-88A AM filter	49.95
YK-88C/YK-88CW 500 Hz CW filter	62.95
YK-88CN 270 Hz CW filter	62.95
BC-1/TK-1 Memory back-up supply	20.00
MB-100 Mobile mount	29.95



TS-830S 9-band digital Xcvr	$949.95
DFC-230 Digital freq controller w/mic	289.95
SP-230 External spkr w/audio filters	71.95
VFO-230 Digital remote VFO	309.95
VFO-240 Analog remote VFO	169.95
YK-88C/YK-88CW 500 Hz CW filt (1st IF)	62.95
YK-88CN 270 Hz CW filter (1st IF)	62.95
YG-455C 500 Hz CW filter (2nd IF)	89.95
YG-455CN 250 Hz CW filter (2nd IF)	113.00
AT-230 9-band tuner/SWR, pwr meter	194.95
SM-220 Monitor scope	$359.95
BS-5 Panadaptor kit for TS-520/S	79.95
BS-8 Pan kit; TS-530S/830S/820S/180S	79.95
TL-922A 2kw PEP linear (Air Freight)	$1229.95

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TR-2500 .3/2.5w 2m FM HT	$329.95
BH-2 Belt hook	4.95
BT-1 Alkaline battery case	11.95
EP-1 Earphone	3.90
LH-2 Leather case	37.95
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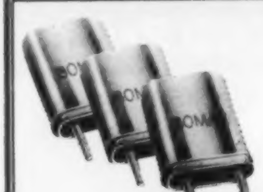

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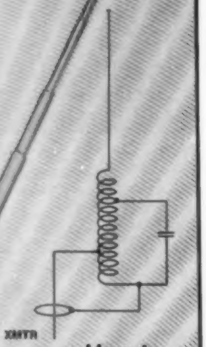
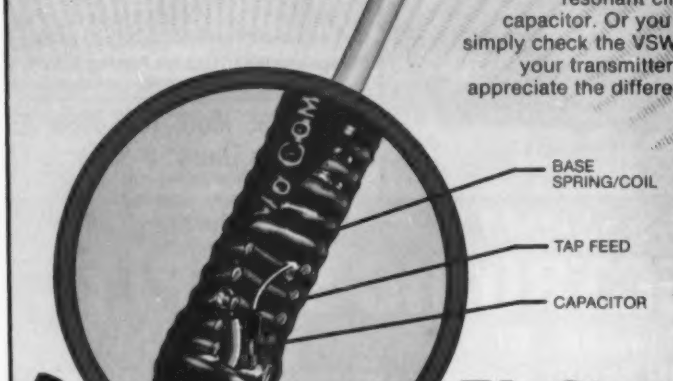
At right is the circuit that does it. The coil that doubles as a base spring is tap fed, and a matched capacitor completes the resonant circuit.



The result is an antenna that, fully extended, displays better than 1.5:1 VSWR across the entire 144-148 MHz band. And, when collapsed, it is the operating equivalent of a rubber duck. (With 8 of the 10 sections extended, it is a 5/8 wave antenna at 220 MHz.)

How to tell a VoCom 5/8 wave antenna from its imitators: this cutaway shows the base spring/coil, its feed tap, and the resonant circuit capacitor. Or you can simply check the VSWR—your transmitter will appreciate the difference.



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- Easy to use mobile mount with instant disconnect knobs for fast, simple removal. DC Cable and mounting hardware, spare fuse, external speaker plug and complete simplified instruction book includes circuit diagrams and even complete alignment instructions! No extras to purchase!

- Control functions: Select memories, show memory channel number, or select memories and show frequency of channel, or dial frequencies with two speed selectable control. Instant choice of either 5 or 100 khz tuning steps. Programmable band scan limits and memory scan.

- Frequency shown in 5 bright LED digits. LED indicator shows when signal is received (unsquelched), LED indicator shows transmit.

- Modern LED bar meter shows signal strength of received signal and on transmit shows relative output power.

- Microphone includes tone pad, and up and down buttons to change dial frequency or memory channels.

- A standard microphone with up-down buttons only is available separately.

- The FM 2030 is basically as easy to use as a crystal receiver with rotary switch frequency selection for full "eyes-on-the-road" mobile operation.

- And, in case we forgot to mention it, we are proud to continue our famous KDK quality and ruggedness!

- Smaller case size: 55mm (2 3/16") high, 162mm (6 3/8") wide, 182mm (7 3/16") deep.

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RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
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I somehow find it hard to believe, but this column marks the beginning of the sixth year of RTTY Loop! Back in 1977, when I started this column in a local club newsletter, the most exotic item I was asked about was the Teletype® Model 28, or occasionally the Model 33. Now, in just a half-dozen years, the bulk of the questions concern adapting any of the myriad of personal computers to RTTY.

Many readers, having sensed my affection for the Motorola 6800 series of computers, have asked about programs directed towards that line. In the past, I have featured quite a few individual programs which allow receiving or transmitting RTTY on a 6800 system. One feature often requested, and certainly available on many commercial RTTY terminals, is the so-called "split-screen" capability. This is the display of both the received signal and transmit buffer on the screen at the same time.

```
0010 INPUT "TYPE A NUMBER",A
0020 IF A>10 GOTO 50
0030 PRINT "L"
0040 GOTO 10
0050 PRINT "H"
0060 GOTO 10
```

Fig. 1.

```
START JSR INPUT
      CMPA 10
      BGT HIGH
      LDAA 'L
      JSR OUTPUT
      BRA START
HIGH  LDAA 'H
      JSR OUTPUT
      BRA START
```

Fig. 2.

Let's take a look at what such a program requires, and over the next few sessions see if we can develop a reasonable technique for implementing a split-screen RTTY terminal. In doing this, I will try to keep within my design philosophy, which is: If it can be done in software, do it. While this sometimes increases the complexity of the written code, I believe that in the long run working out a logical software solution to problems provides both a straightforward method of problem-solving and a cost-effective approach for the ham on a budget.

The first step will be to define what this terminal will need to do. Let's require only the ability to handle 60-wpm Murray (Baudot) code; other speeds will not be hard to add, and a given code set will keep things simple for the time being. I would like the top half of the screen to display the received signal, with the most recent lines being maintained, and the bottom half to show the transmit buffer. You should be able to fill the transmit buffer while receiving and continue to add to it even while transmitting.

I am going to have to be rather specific on the hardware requirements. We will be writing for a Motorola 6800-based computer, with the I/O block located at $8000, using the old "SWTPC" standards. A video-mapped display will be a must. Users of "smart" terminals, such as the Soroco IQ-120, can position the cursor anywhere using escape sequences, and this could be used to implement a split-screen display. However, in order to selectively scroll the screen, manipulation of data will be required directly, and this will necessitate the type of access a video board allows. While I will be writing for a GIMIX board, the program should be general enough to allow any of the popular video displays to work.

Now, on to the program. In the past, I have received some letters critical of my rapid entry into source codes. It seems that all of you are not as comfortable as I in the realm of LDAA and CPX instructions. I therefore shall wade in from the shallow end, although I prefer diving right in. Let's start by looking at the logic involved for this program.

Well, not just yet. You see, that's been another criticism. Flowcharts, those indispensable tools of the computer programmer, are just so much gobbledygook to a good number of you. I have, in the past, presented several flowcharts without much in the way of background. I shall attempt to rectify this omission herewith.

A flowchart is a map, diagram, or skeleton of a computer program, depending on how you look at it. Let's take a rather simple example. I say something like, "Take a number and call it A. Is it greater than 10? If so, print an H. If not, print an L. Now do it again." This sequence defines a logic sequence. Many of you familiar with BASIC, the rather universal higher-level language used in personal computers, could write rather rapidly from this description the program shown in Fig. 1. This would be one way to accomplish the task. Another is shown in Fig. 2, which is a 6800 assembly-language implementation of the same simple-minded job. I think you can see that there is quite a difference, and can imagine further differences when the process is extended to 6502-, 8080-, Z-80-, Pascal-, FORTRAN-, or APL-speaking computers. What is needed is some universal way to represent the logic sequence. That is the flowchart.

Steps in a flowchart are represented by boxes, each of which contains one logical process. This process may be a simple one-byte instruction or an entire subroutine. It doesn't matter, so long as it can be visualized as a unit. Different shaped boxes are frequently used to represent different types of processes. Three of those are shown in Fig. 3, with their definitions. There are many others, but these three will suffice for this month's flowchart.

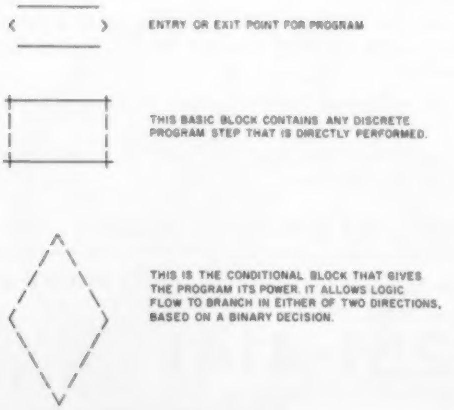
ENTRY OR EXIT POINT FOR PROGRAM
THIS BASIC BLOCK CONTAINS ANY DISCRETE PROGRAM STEP THAT IS DIRECTLY PERFORMED.
THIS IS THE CONDITIONAL BLOCK THAT GIVES THE PROGRAM ITS POWER. IT ALLOWS LOGIC FLOW TO BRANCH IN EITHER OF TWO DIRECTIONS, BASED ON A BINARY DECISION.

Fig. 3.

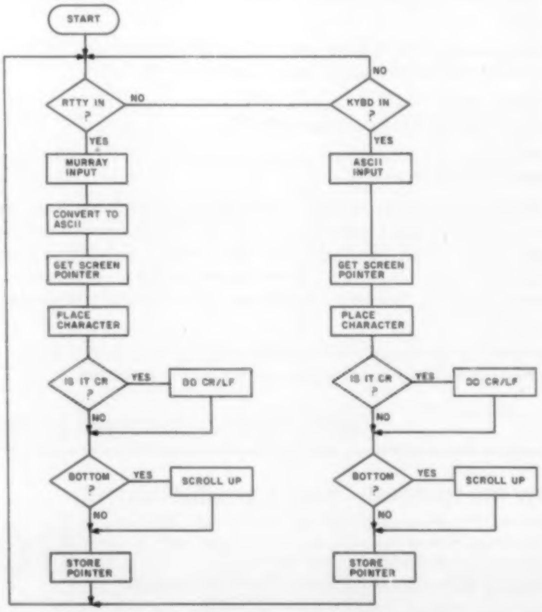

Fig. 4. Simple split-screen RTTY.

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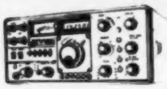

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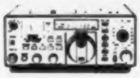

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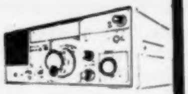

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With this under our belts, let's take a look at the flowchart in Fig. 4. Entering at START, we immediately come to a decision. If there is a bit on the RTTY input pin, then a character is about to come in. If not, the local keyboard can be checked for input. If no data is found there, the program returns to check the RTTY once again and the loop continues.

If a character has been typed on the local keyboard, it is inserted into a buffer and displayed on the lower half of the screen. Later on, we will add some checking for special characters which will control the program or other features. For now, let's just be happy to fill the buffer.

Received RTTY characters are also stuffed onto the screen, but on the top half. During receipt of the RTTY character, however, there is quite a bit of time when the computer would be idling, waiting for these long, 21-ms pauses to go by. During these pauses, as shown in Fig. 5, the keyboard is checked once again. Input is allowed here, too, and again placed on the screen and stuffed into the buffer.

All this inputting and buffering requires a raft of pointers and protocols. Placing a character on the screen will require pulling a set of pointers from storage, placing the character on the screen, updating the pointers, checking to see if a new line must be started, and possibly scrolling that segment of the display. And all this must be accomplished within the wink of an eye.

Now that we have the road map, let's begin our journey. The program we will use is an implementation of an output routine which will serve as the window into the RTTY terminal we will be building. Before I go into the ins and outs of the program itself, maybe I'd better explain some of the rather peculiar GIMIX system function calls.

Like most operating systems, the GMXBUG monitor features a variety of routines which may be used to input or output characters or manipulate data in various ways. Unlike most, which use subroutine calls to access such routines (JSR ADDR or $BD $nnnn), GMXBUG provides for the use of the software interrupt (SWI or $3F) instruction to create a set of two-byte pseudocodes. In the typical sense, one may write the code $3F $10 to input a character, for example, rather than the MIKBUG style $BD $E1AC (JSR INEEE).

Moreover, GMXBUG features several routines not offered in other 6800 monitors, many of which demonstrate a high level of utility. While these routines may be written in for systems based on another monitor, as long as they are here, why not use them? In order to allow the assembler to handle these two-byte pseudocodes, I write them as double-byte data statements (FDB) and call them as such.

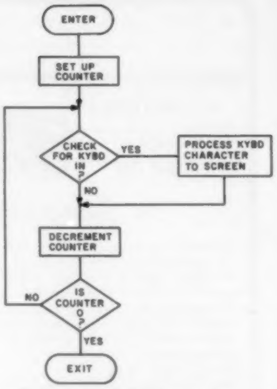
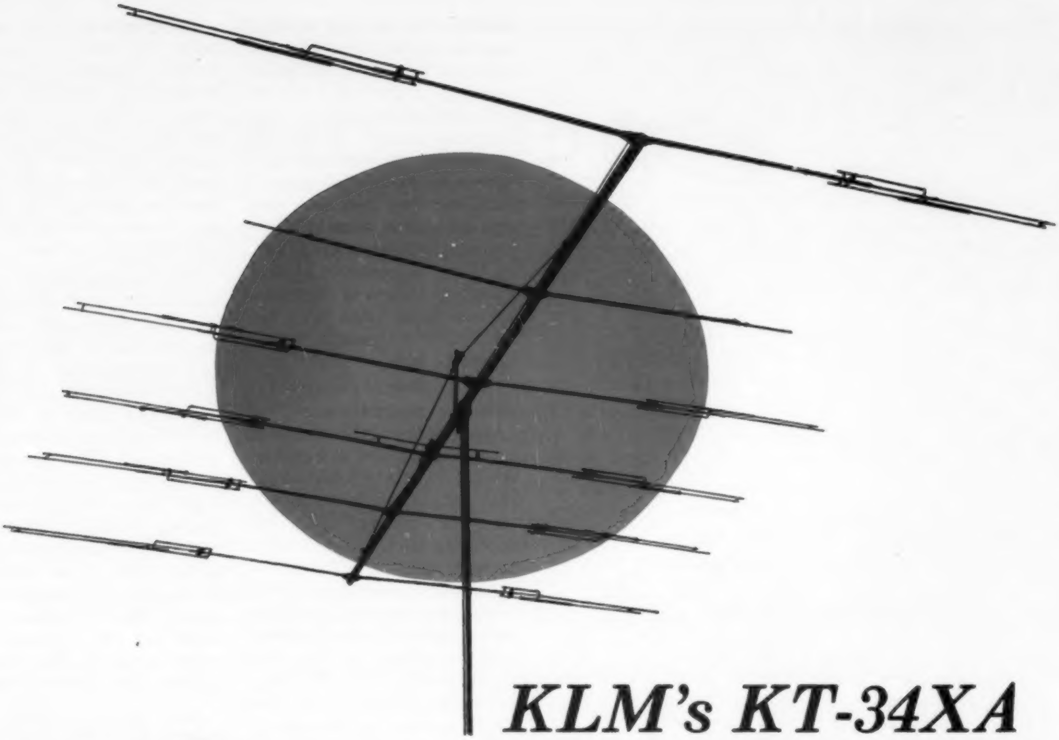


Fig. 5. Murray input delay routine.

```
                      NAM   HALF SCREEN TEST
              ******************************
              * DEMONSTRATION ROUTINE TO *
              * OUTPUT ON THE LOWER HALF *
              *      OF A GIMIX VDM      *
              *    VERSION 1.00 - FOR    *
              *  RTTY LOOP : JULY, 1982  *
              *    MARC I. LEAVEY, M.D.  *
              ******************************
                      OPT   NOG,NOB
              *
              * GIMIX FUNCTION CALLS
              *
3F04          ADDAX   EQU   $3F04        Add ACCA to INDEX
3F06          SUBAX   EQU   $3F06        Subtract ACCA from INDEX
3F0E          MOVER   EQU   $3F0E        Block Move Routine
3F11          OUTCHR  EQU   $3F11        Normal character output
A002          BEGIN1  EQU   $A002        Lower bound for move
A004          END1    EQU   $A004        Upper bound for move
A014          BEGIN2  EQU   $A014        Lower bound to go to
              *
              * ENTRY POINT
              *
A800                  ORG   $A800        Unused in my system
A800 81 0D    HAFSCR  CMP A #$0D         Is it CR?
A802 27 15            BEQ   DOCR
A804 81 0A            CMP A #$0A         Is it LF?
A806 27 14            BEQ   DOLF
A808 81 07            CMP A #$07         Is it BELL?
A80A 27 13            BEQ   DOBELL
A80C 81 0C            CMP A #$0C         Is it FF?
A80E 27 12            BEQ   DOFF
A810 81 08            CMP A #$08         Is it BS?
A812 27 11            BEQ   DOBS
A814 81 20            CMP A #$20         Is it a Control Char?
A816 2C 10            BGE   PRINT
A818 39       HAFXIT  RTS
              *
A819 7E A846  DOCR    JMP   CARRET       * Jumps to
A81C 7E A855  DOLF    JMP   LINFED       * wherever called
A81F 7E A894  DOBELL  JMP   BELL         * for by the
A822 7E A897  DOFF    JMP   FRMFED       * control
A825 7E A8B1  DOBS    JMP   BAKSPC       * character
              *
A828 FE A8C6  PRINT   LDX   LOCATE       Get spot for char
A82B A7 00            STA A X            Put char there
A82D 08               INX
A82E FF A8C6          STX   LOCATE       Save next spot
A831 F6 A8CC          LDA B COUNT        Get line char count
A834 5C               INC B
A835 F7 A8CC          STA B COUNT
A838 F1 A8CD          CMP B ENDLIN       Is line full?
A83B 27 01            BEQ   NEWLIN       Yes, do CR/LF
A83D 39       PEXIT   RTS
              *
A83E BD A846  NEWLIN  JSR   CARRET       Go do CR
A841 BD A855          JSR   LINFED       and LF
A844 20 F7            BRA   PEXIT        then exit
              *
              *
A846 FE A8C6  CARRET  LDX   LOCATE       Get current locale
A849 B6 A8CC          LDA A COUNT        And current nr of chars
A84C 3F 06            FDB   SUBAX        Subtract the two
A84E FF A8C6          STX   LOCATE       Store that
A851 7F A8CC          CLR   COUNT        Clear char count
A854 39       CARXIT  RTS
              *
              *
A855 B6 A8D0  LINFED  LDA A ROWNR        Get current row nr
A858 B1 A8CF          CMP A HIROW        Are we at bottom?
A85B 27 10            BEQ   SCROLL       Yes... do a scroll
A85D 4C               INC A              No, just a line feed
A85E B7 A8D0          STA A ROWNR        Store new row
A861 FE A8C6          LDX   LOCATE       Get old location
A864 86 50            LDA A #80
A866 3F 04            FDB   ADDAX        Add 80 to locale
A868 FF A8C6          STX   LOCATE       And replace old data
A86B 20 26            BRA   LFEXIT       Then exit
A86D FE A8C8  SCROLL  LDX   BGNVDM       A scroll! First set up
A870 FF A014          STX   BEGIN2       vectors for MOVER
A873 86 50            LDA A #80          80 + BGNVDM
A875 3F 04            FDB   ADDAX        equals start of 2nd line
A877 FF A002          STX   BEGIN1
A87A FE A8CA          LDX   ENDVDM
A87D FF A004          STX   END1
A880 3F 0E            FDB   MOVER        Block move text up 1 line
A882 FE A8CA          LDX   ENDVDM       Find end of screen
A885 86 50            LDA A #80
A887 3F 06            FDB   SUBAX        Go back 80
A889 86 20            LDA A #$20         Then fill
A88B A7 00    SCLOOP  STA A X            from there to
A88D 08               INX                the end with
A88E BC A8CA          CPX   ENDVDM       spaces
A891 26 F8            BNE   SCLOOP
A893 39       LFEXIT  RTS                Exit when done
              *
              *
A894 3F 11    BELL    FDB   OUTCHR       Just send the BELL out the
A896 39               RTS                old fashioned way!
              *
              *
A897 FE A8C8  FRMFED  LDX   BGNVDM       Make the beginning the
A89A FF A8C6          STX   LOCATE       current location
A89D 7F A8CC          CLR   COUNT        Counter = 0
A8A0 B6 A8CE          LDA A LOROW        and reset the
A8A3 B7 A8D0          STA A ROWNR        row counter
A8A6 86 20            LDA A #$20         Take a space
A8A8 A7 00    FFLOOP  STA A X            store it at index
A8AA 08               INX                increment across the screen
A8AB BC A8CA          CPX   ENDVDM       Are we at end?
A8AE 26 F8            BNE   FFLOOP       No, keep it up
A8B0 39       FFEXIT  RTS                Otherwise, exit
              *
              *
A8B1 F6 A8CC  BAKSPC  LDA B COUNT        If the char count is 0
A8B4 27 0F            BEQ   BSEXIT       just exit
A8B6 5A               DEC B              Otherwise decrement the count
A8B7 F7 A8CC          STA B COUNT        and store it
A8BA FE A8C6          LDX   LOCATE       Get the location vector
A8BD 09               DEX                decrement that
A8BE 86 20            LDA A #$20         Then stick a space
A8C0 A7 00            STA A X            there
A8C2 FF A8C6          STX   LOCATE       then store the vector
A8C5 39       BSEXIT  RTS                and we are done
              *
              *
A8C6 F4 10    LOCATE  FDB   $F410        Address of next char
A8C8 F4 10    BGNVDM  FDB   $F410        Start of VDM
A8CA F7 7F    ENDVDM  FDB   $F77F        End of VDM
A8CC 00       COUNT   FCB   0            Current char count
A8CD 50       ENDLIN  FCB   80           Char's per line
A8CE 0D       LOROW   FCB   13           Nr of lowest row
A8CF 17       HIROW   FCB   23           Nr of highest row
A8D0 0D       ROWNR   FCB   13           Current row
              *
              *
                      END
     NO ERROR(S) DETECTED
```

Fig. 6.



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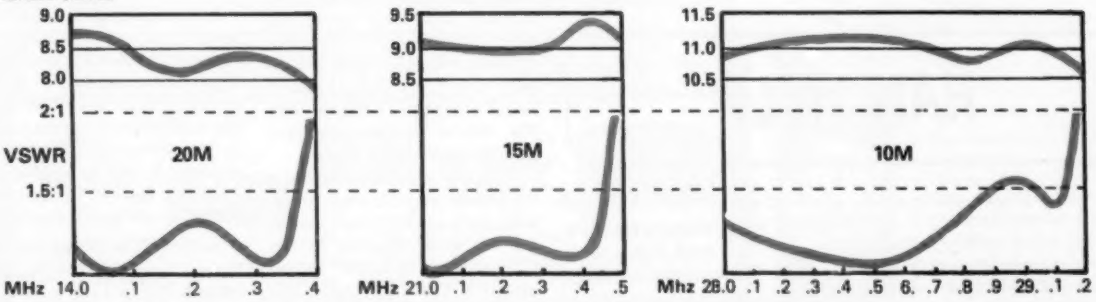

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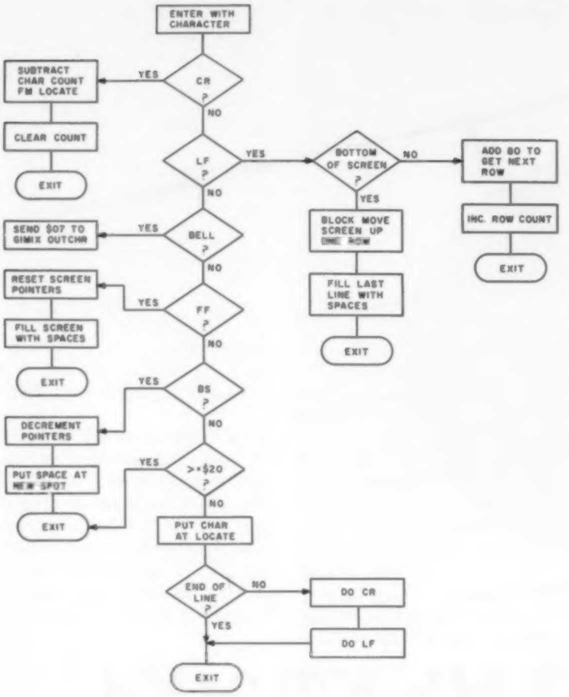

Fig. 7.

Routines used in this month's program include:

ADDAX ($3F04)—Adds the contents of accumulator A to the contents of the index register and places the result in the index register. The addition is unsigned. The former contents of the index register are lost.

SUBAC ($3F06)—Subtracts the contents of accumulator A from the contents of the index register and places the result in the index register. The subtraction is unsigned. The former contents of the index register are lost.

MOVER ($3FOE)—A general purpose block-mover routine. Moves the contents of memory starting at the address in BEGIN1 ($A002) through the address in END1 ($A004) inclusive to memory starting at the address in BEGIN2 ($A014). Checks for overlap of source and destination areas. If necessary, the move is done back-to-front.

OUTCHR ($3F11)—Conventional character output to the video-driver routines of the ASCII character contained in the A accumulator.

Enough background? OK, let's see how we can chop a screen in half. The listing in Fig. 6 is a demonstration program to do this. The flowchart in Fig. 7 can be followed step by step, to see how the listing was developed.

To begin with, we shall recognize that certain non-printing characters are useful, so let's screen for them. A carriage return, line feed, bell, form feed, and backspace, each in turn is checked for. Should any of them be found, a branch to a corresponding routine is done, and we will cover those later. Any other control character we will ignore for now.

The handling of printing characters is straightforward. The address of the next character to be printed is stored at a spot we will call "LOCATE." So, we get that address, place the character there, increment to the next spot, and store it. Now, a line counter, call it "COUNT," is incremented to see where on the line we are. If at the end, calls to the carriage-return and line-feed routines initiate a new line. Which routines are these? Why, the same routines that a carriage return and line feed call up, no? Yes! And I bet you thought this was going to be complicated.

Now let's take a look at some of those special routines. What's that I hear? OK, carriage return, you first. What is a carriage return after all? A resetting to zero on the current line, that's all. So, to implement a carriage return, first we load the current location into the index register, then the character count (where on the line are we?) into the A accumulator. Subtract the two, using that SUBAX routine, and you have the beginning of the line. Store that as the new location, clear the line count itself, and the carriage return is done.

Line feed? No, let me save you for last. How about something easy, like the bell. This non-printing character rings a software bell in the GIMIX system. So let's just send it out through the regular character output. Well, so much for that one.

The form feed is used to clear the screen, and it is a neat character; let's see why. First, we set the character location to the first one in the screen sector, clear the character count and set the row counter to the first row. Next a loop is entered to load the entire screen window with spaces ($20). When that's done, the screen is reset and clear.

Backspace is also not so hard. For now, let's prohibit backspacing past the beginning of the line up onto the previous line. So, we check the character counter and if it's zero we don't backspace. If it's OK, just decrement the count, store it, decrement the location, store it, and put a space where we are now. Like I said, not so hard.

OK gang, time to roll up our sleeves and look at the line feed. If we take it one step at a time, it shouldn't be too hard. We have been keeping track of current row on the screen, as well as character position on the line. So first we must check the row counter and, if the current row is the last on the screen, initiate a scroll. Hang onto that one for a second. If not a scroll, it is easy. With eighty characters per line, adding eighty to the current location gives the corresponding spot on the line below. Increment the row number, add eighty to the location, store all this new data, and we are done.

Now, about that scroll, let's look. First, we find the start of the second screen line; this will become the top line after the scroll. This address is stored in BEGIN1 for use by the MOVER routine. The end of the screen defines END1, and the data on display is shifted up one line. Now one more task needs to be taken care of. The last line on the screen is filled with spaces, clearing it for new data.

Note, by the way, that the carriage return does not initiate a scroll, nor does a line feed reset position within a line. It takes both!

The data and storage needed for the program is situated at the end of the instructions. I've got to indicate here that there is nothing sacred about using the bottom thirteen lines, as shown here, or the whole eighty characters across. Change it to the middle sixteen lines with thirty-two characters if you are nostalgic. Versions of this same routine will be used for several windows in the RTTY terminal which we will be building up.

As time goes on, we will continue to develop the routines needed, one by one, for this full-featured RTTY terminal. Next month, though, I'll take a crack at some of the mail from readers which has been piling up on my desk. That and more, in RTTY Loop to come.

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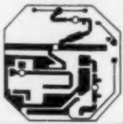

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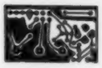

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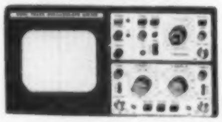

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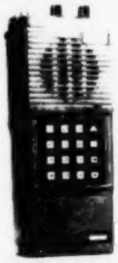

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DONS CORNER

This month begins a different Don's Corner - A review from the dealer's standpoint of various radios, good & bad, based on functions, service, ease of operation, and resale. (I'll also include our ever popular helpful hints as they come to mind.) Heads may roll (mine) since the aim is to sell radios **but** I want you to get the radio **you** want - not what I recommend or how our clever ads portray various sets.

Rockwell/Collins KWM380 - overpriced compared to the others but not going to be superseded by a new model next weekend. Yaesu FT-ONE - close to the KWM380. Time will tell if as reliable (We'll tell you.)

New TS930S - Too soon on this one, but the auto antenna tuner is nice.

More next month (Remember - You're only as good as your next big rig purchase at Madison!)

[Note: All items shipped fresh stock, factory sealed cartons, no seconds, no demos. Personal Guarantee on all items sold. Can be returned, unscratched & boxed within 2 weeks for refund.]

See you next month!

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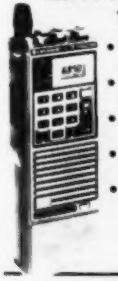

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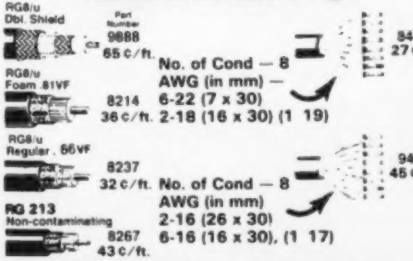

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TVRO: Georgia Style

—one man's junk is another man's antenna

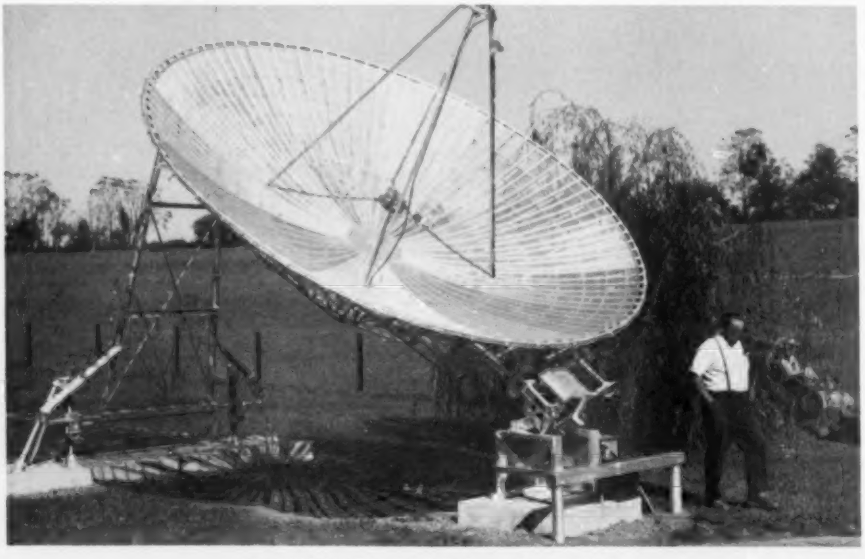
Timothy Daniel N8RK
73 Magazine Staff

This is not the typical *73* construction article. Herman "Tex" Friedsam's satellite TV antenna is not offered in kit form, nor are a complete set of plans available.

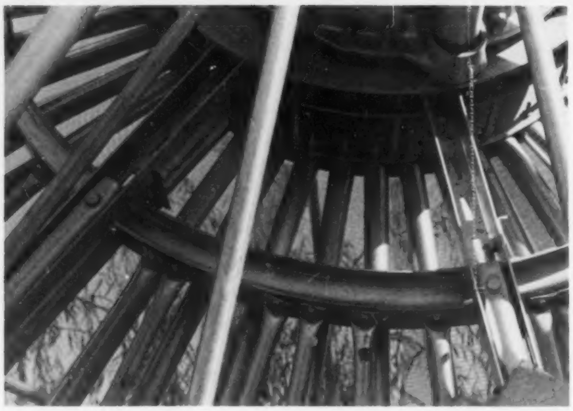
Just in case you still want to give this project a try, here are some of the parts you will need: the magnesium bell housing for a helicopter's propeller, one line shaft from a cotton gin, and don't forget the swivel-type hitch from a cultivator. With those items acquired, it is time to continue the search, this time looking for a worm gear reducer (Tex salvaged his from a brick factory's conveyor); you'll also need a frame for the drive mechanism—try the local hammer mill.

What may sound like a hopelessly incompatible pile of junk has become an engineering masterpiece in the small town of Marshallville, Georgia. Tex, whose ham call is WA4OPY, approached this project like he does most things. Using his experience as a textile plant engineer, he started with an idea but not a plan. After collecting several of the key components, he settled on a design for a 15.27888-foot-diameter parabolic reflector. The 18 hours of research and planning were among the project's easiest work. Construction of the frame, which began in the spring of 1979, took almost 200 hours. Realizing that painstaking accuracy results in a better picture when you are done, Tex and a friend each spent 12 hours making a plywood template of the antenna's curved surface. Two thousand feet of electrical conduit and PVC pipe later, the frame was ready to cover with aluminum screen. The basic dish, when completed, weighed only 425 pounds.

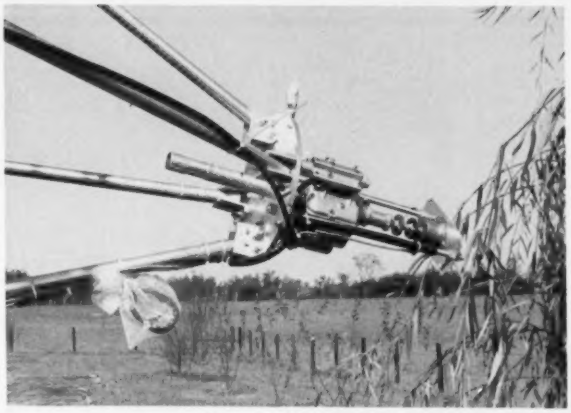
Tex's research pointed out the imperfections of the polar mount, the traditional way a dish scans the hori-



Tex WA4OPY with his home-brew dish.



The antenna's hub is constructed around a helicopter's propeller bell housing. An octagonal frame, eight feet in diameter, extends outward, supporting the antenna's surface.



The feed assembly allows the horn polarization to be changed via a TV rotor and there is provision for very fine adjustments of the horn location. This allows the receive signal to be maximized.

zon. By building a frame that could be moved horizontally as well as in a polar arc, the WA4OPY antenna can be accurately positioned with a minimum of fudging. The major supporting axis is the only part of the system fabricated by an outsider. A 1/2-horsepower motor used to turn the dish is the only component that was purchased new. The rest of the parts were salvaged from local scrap piles. Being the owner of a hardware and variety store didn't hurt, nor did Tex mind using "scrap" from his brother-in-law's grain mill.

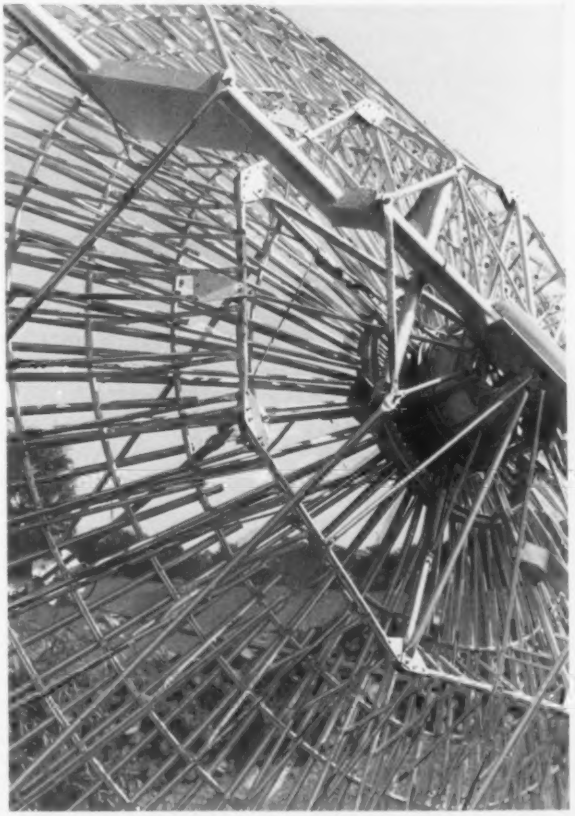
Patience seems to be the main rule behind this project. When it came time to fine-tune the antenna's surface, Tex spent 61 hours, much of it with a flashlight and a piece of shiny aluminum. When he was finished, the dish's focal point was no bigger than a nickel. As Tex got around to building a feed assembly, he decided that there was nothing suitable on the commercial market, so he designed his own. It worked so well that he has started to manufacture them for other hobbyists.

By April of 1981, almost two years after he started construction, Tex was ready to give his system a try. The electronics, like the antenna, were home-built. The first pictures, in Tex's words, were "lousy images of a Snoopy cartoon." Today, "lousy" pictures have been replaced by clear reception and satellite television has become part of the Friedsam family life. The receiver has been built into an attractive piece of living room furniture and the dish, which sits across the driveway, moves somewhat mysteriously by remote control.

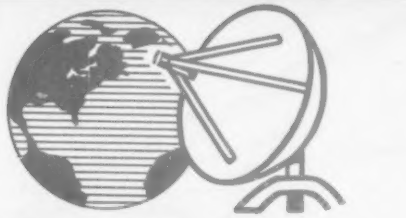
Tex carefully documented the construction of his system, keeping track of the materials and time he used. For instance, 1700 3/8-inch sheet-metal screws were needed to apply the aluminum screening, and it took 29 hours to install a shielded underground cable between the house and the dish.

Along the way there were many sources of frustration; for example, the frame broke when it was ninety percent complete. Tuning up the microwave circuitry required a signal generator that none of the local scrap piles could offer. Tex built his own, using a klystron tube.

Perhaps the most impressive fact concerning Tex's accomplishment was that he had never seen a TVRO installation and he had never been within a mile of a large parabolic antenna. Working from theory and the scrap piles of Marshallville, Georgia, he has built a functional monument to the home-brew spirit of radio. ■



The dish, which is almost 16 feet in diameter, has a frame built from PVC pipe and electrical conduit. The supporting bar, which spans the dish, is the only piece that Tex did not fabricate himself.



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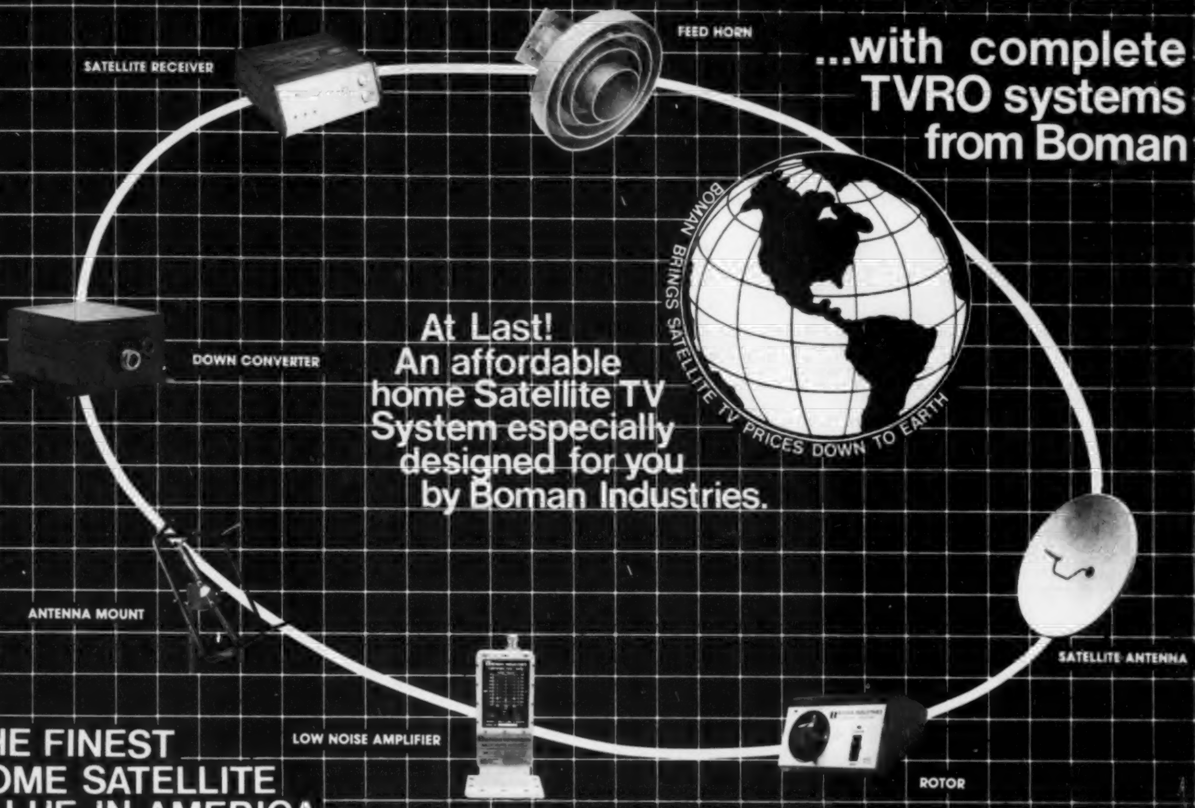
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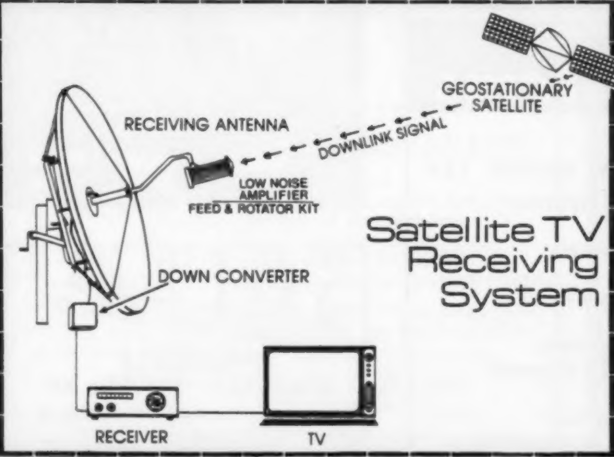
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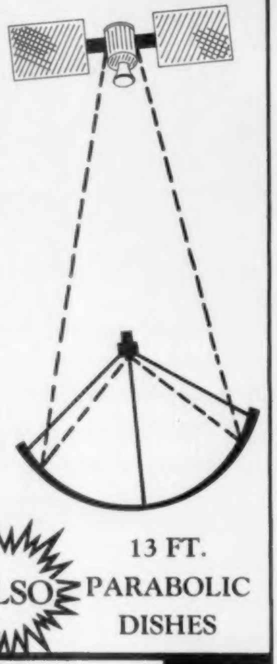

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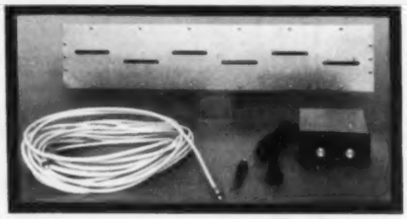

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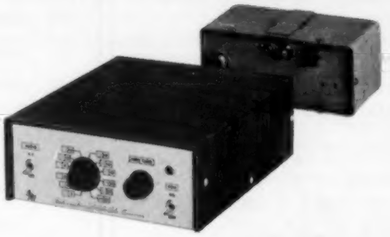

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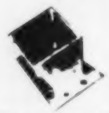

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100 ft. RG8U with PL-259 on each end	**$19.95**
BELDEN Coax in 100 ft. rolls	
RG58U #9201	**$11.95**
Grounding strap, heavy duty tubular braid	
3/16 in. tinned copper	**10¢/ft.**
3/8 in. tinned copper	**30¢/ft.**

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RG213 noncontaminating 95% sheild mil spec.	36¢/ft.
RG174/U mil spec. 96% shield	10¢/ft.
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RG6A/U double shield, 75-ohm	25¢/ft.
RG58AU stranded mil spec	12¢/ft.
RG58 mil spec. 96% shield	11¢/ft

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RG58U 80% shield	07¢/ft.
RG58U 95% shield	10¢/ft.
RG59U 100% foil shield, TV type........ $7/100 ft.	10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214)	31¢/ft.
Rotor Cable 8-con. 2-18 ga, 6-22 ga	19¢/ft.

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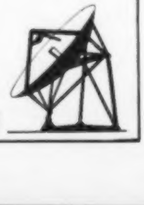

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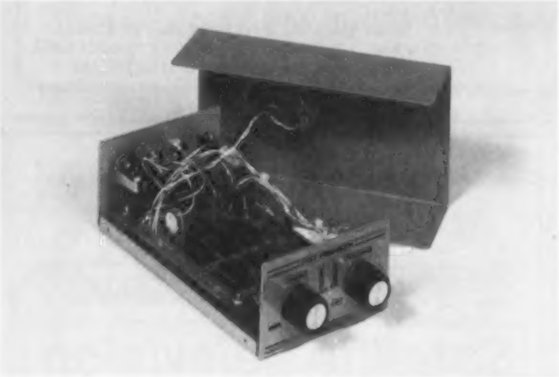
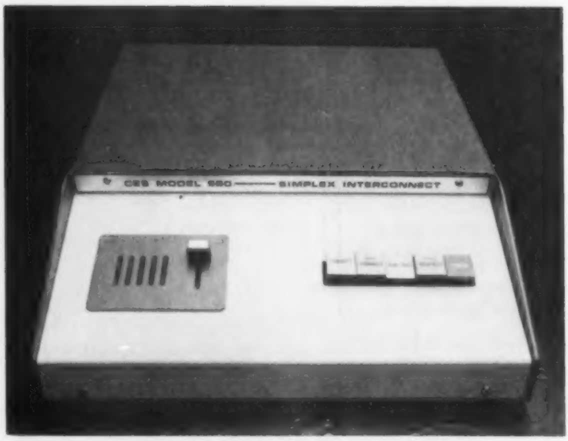
PHONE INTERCONNECT

The CES Model 560 interconnect is designed to interconnect a base station or control station to a telephone line. The 560 is a sampling type of interconnect, using no VOX circuits for control. The Model 560 is one way that repeaters located away from phone lines can have autopatch capability. When the interconnect is in use, the control station will transmit for one second and then sample the receiver for ten to twenty-five milliseconds to determine if a station is transmitting. If a signal is found, the control station will stay on receive until it stops; if no signal is present, the control station will transmit for another second.

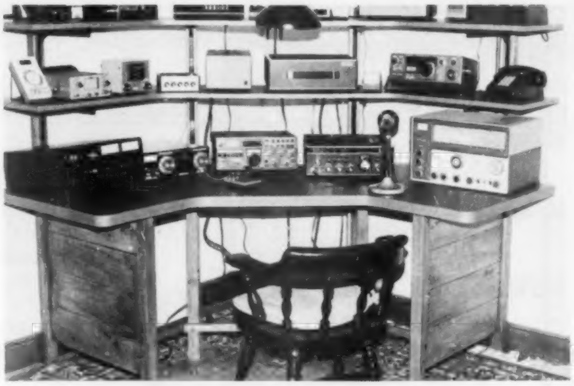
Toll-restrict and dial-out capability can be enabled by front-panel switches. The Model 560 does not affect the use of the control station for normal communication. It is priced at $990. For more information, contact *Communications Electronics Specialties, Inc., PO Box 507, Winter Park FL 32790.* Reader Service number 478.



The Fist Fighter.



CES's Model 560 phone interconnect.



CQ Products' operating desk.

SHACK FURNITURE

CQ Products announces the introduction of an operator's desk designed like an organ console to place all the operator's equipment within easy view and reach. The desk surface and shelves are constructed of 200-pound industrial-grade chipboard and are covered with formica. The two shelves are adjustable in height to accommodate virtually any ham or computer gear.

The desk is designed to fit into the corner of your ham shack and is also attractive enough to be placed in your living room or den. The desk occupies 60 inches from the room corner to each edge. It is priced at $495. For more information, contact *CQ Products, 8280 Janes Avenue, Suite 137-1700, Woodridge IL 60517.* Reader Service number 476.

MICRO SOLDERING STATION

The Wahl Clipper Iso-Tip 7470 micro soldering station eliminates continuous switching to maintain temperature and, therefore, the spikes that can damage delicate electrical components. The totally grounded unit can be adjusted for any temperature between 500 and 700 degrees F. With the selection of the proper tip, heat is delivered only to those points where it is needed. The temperature-adjustable soldering station comes complete with sponge holder, tip-wiping sponge, soldering iron, and stand. The suggested price is $47.75. For further information, contact *Wahl Clipper Corp., PO Box 578, Sterling IL 61081.* Reader Service number 479.

VHF KITS

The R76 VHF FM receiver kit is an improved version of the R75 receiver for 10m, 6m, 2m, 220 MHz, or the adjacent commercial bands. It features a very low-noise front end, pump-resistant squelch with hysteresis to lock onto fading signals, onboard volume and squelch controls for easy wiring, and fixed i-f filters for easy alignment. It is available in two selectivity options, starting at $84.95.

A new UHF receiver kit has also been introduced. The

Wahl's Iso-Tip 7470 micro soldering station.

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RG-213	27¢/ft
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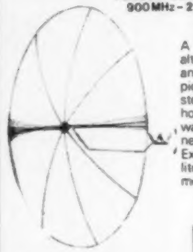

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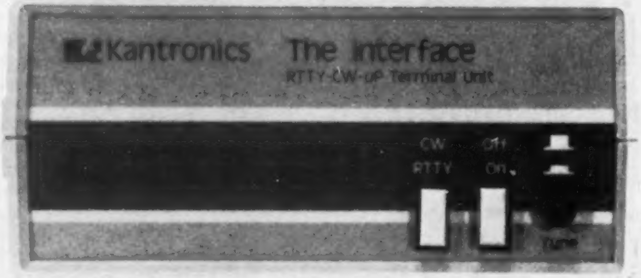

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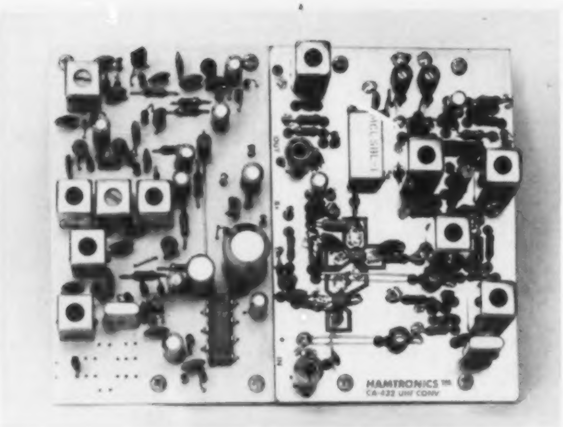

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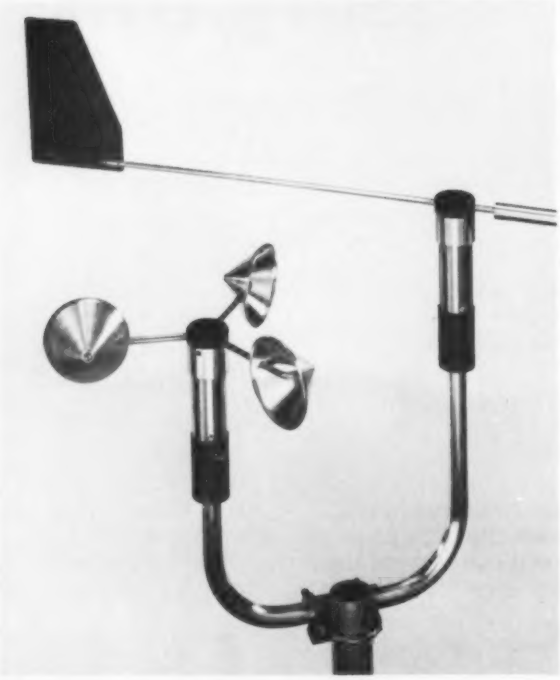

TMAC Products' S.D.-500 weather station.

model R451 includes the features listed above plus automatic frequency control to lock onto drifting transmit signals. Kits are available with various options starting at $94.95.

Hamtronics has a new line of low-noise amplifiers. In appearance, they resemble Hamtronics' earlier P30 and P432 receiver preamplifiers, but the circuit is new. They are optimized for lowest noise figure in the ham bands but can also be used on adjacent commercial bands. Noise figures typically run 0.5 dB at 28 and 50 MHz, 0.6 dB at 144 MHz, 0.7 dB at 220 MHz, and 0.95 dB at 432 MHz. Gain runs from 33 dB at 28 and 50 MHz to 17 dB at 432 MHz.The price is $39.95 for the VHF units and $44.95 for the UHF unit, all wired and tested.

The Hamtronics R110-450 UHF AM aircraft receiver may be used to listen to the Space Shuttle. Good results have been reported using simple UHF antennas. The special Shuttle receiver kit is available off the shelf for $94.95.

For further information on these products, write to *Hamtronics, Inc., 65-V Moul Road, Hilton NY 14468; (716)-392-9430.* Reader Service number 480.

WEATHER STATION

TMAC Products is introducing the S.D.-500 weather station. This system provides wind velocity indications from 0-100 mph and wind direction readings covering 16 compass points. The console is constructed of hand-finished mahogany and the transmitter can be up to 300 feet away from the console and a 50-foot cable is supplied. The unit is powered by 155 volts ac. The list price is $360. For more information, contact *TMAC Products, PO Box 28341, Columbus OH 43228.* Reader Service number 483.

ANTENNA TUNER

The Palomar Engineers PT-407 is a general-purpose tuner for 1.8-30 MHz to match antennas fed with coaxial or open-wire lines, single-wire or mobile antennas. The 300-Watt power rating makes it just right for most transceivers. The PT-407 is an efficient tuner with a large airwound coil, a large balun for open-wire feed, and ceramic insulation throughout. It is housed in an 8" × 4" × 7" aluminum cabinet. All controls are on the front panel, coaxial connectors are S0-239, and porcelain insulators are used for balanced lines and single-wire inputs. The PT-407 antenna tuner sells for $149.95. For more information, write to *Palomar Engineers, 1924-F W. Mission Road, Escondido CA 92025.*

SATELLITE STATION

The Ten-Tec Model 2510 contains a 435-MHz USB/CW transmitter and a high dynamic range 2-meter-to-10-meter receive converter. The Model 2510 and a 10-meter SSB/CW receiver provide full duplex, transmit, and receive functions for operating on the upcoming OSCAR Phase 3 satellite in Mode B.

The transmitter operates from 435 to 435.5 MHz (coverage can be extended to 437 MHz with an optional oscillator). Ten Watts out is available in USB and CW. The receive portion converts 144-146 MHz to 28-30 MHz. A 12-volt power supply is required. Amateur net price for

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AEA's MBA-RC reader/converter.

Yaesu's FT-290R transceiver.

the Model 2510 is $489. For more information, contact *Ten-Tec, Sevierville TN 37862.*

READER/CONVERTER

The Advanced Electronics Applications MBA-RC (Morse, Baudot, ASCII Reader/Code Converter) is actually several sophisticated devices all wrapped up in one package. The unit performs as a full-function decoder and display unit for Morse-, Baudot-, and ASCII-coded signals, operating directly from the audio output of any stable communications receiver. The MBA-RC also encompasses a Morse, Baudot, and ASCII encoder and code converter. The unit will perform serial-to-parallel and parallel-to-serial code conversions as well as cross-mode conversions. All the necessary analog processing and tone generation for two-way contacts in any MBA codes is included.

Other features include a built-in sidetone monitor, an FSK tone generator, and an automatic station ID message. The MBA-RC has a list price of $469.95. For more information, contact *Advanced Electronic Applications, PO Box 2160, Lynwood WA 98036.* Reader Service number 477.

PORTABLE TRANSCEIVERS

The FT-290R and FT-690R are multi-mode battery portable transceivers for 2 meters and 6 meters, respectively. Designed for 2.5 Watts output on SSB, CW, and FM (the FT-690R also has AM), these transceivers use liquid crystal displays and include scanning in variable steps. The FT-290R and FT-690R are powered by alkaline or nicad C-cells (not supplied). The FT-290R is priced at $399 and the FT-690R is offered for $379. For more information, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 481.

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Bandwidth(2M), 1.5:1 VSWR	3.5MHz min	Length extended(1¼M)	43 7/8"/1115MM
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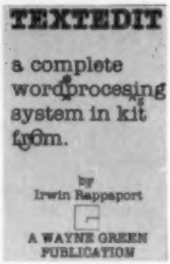
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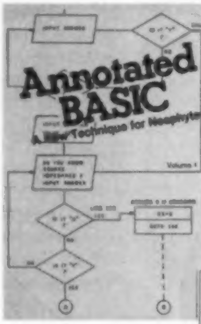

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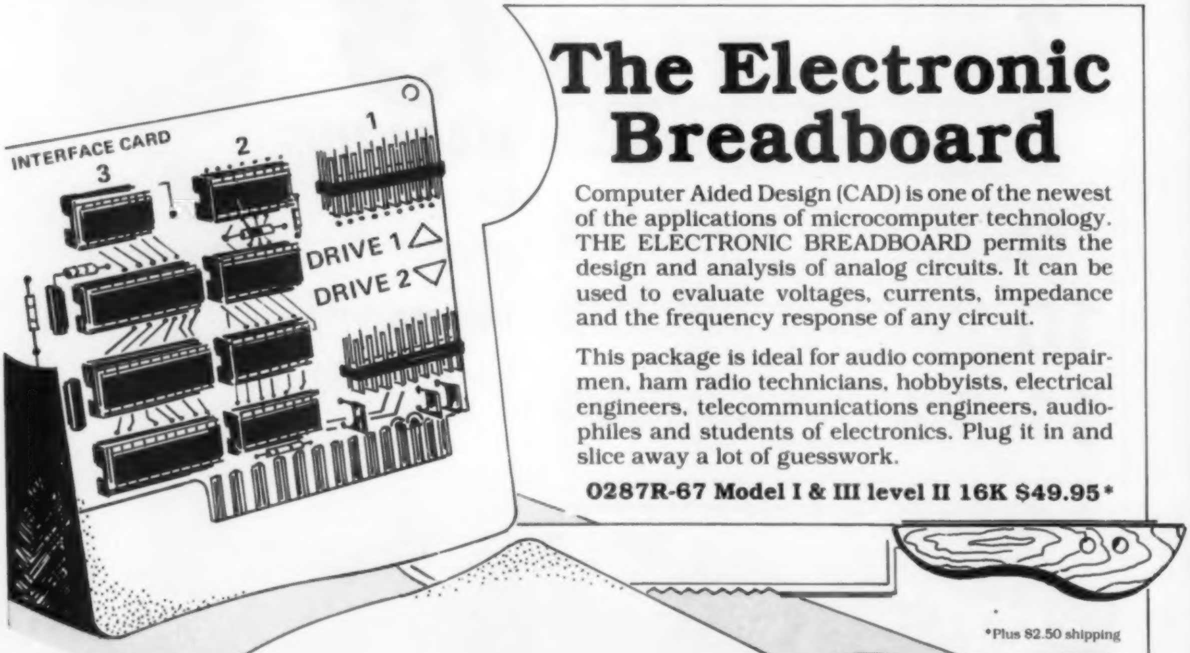

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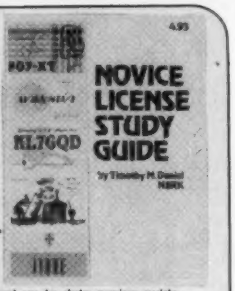

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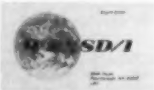

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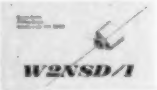

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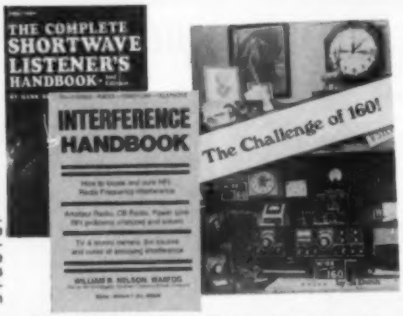

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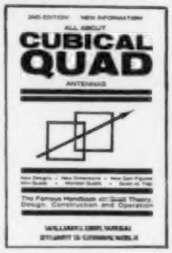
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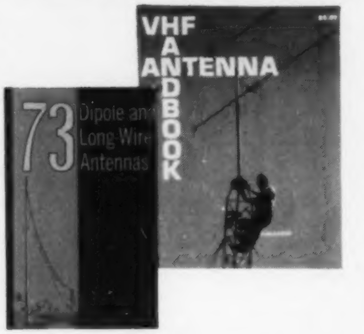

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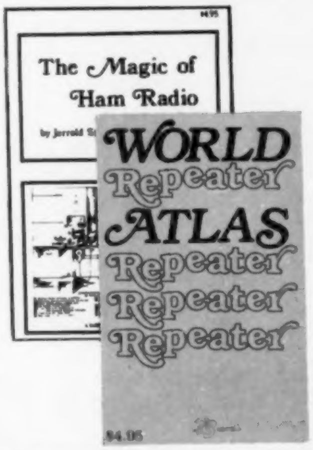

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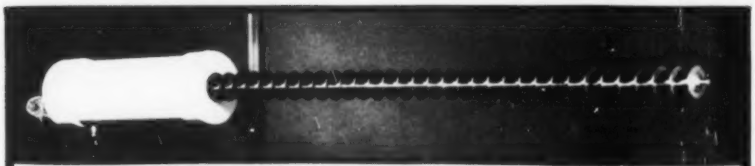

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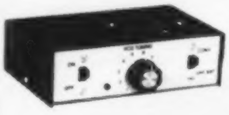

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Dick Levy WB3EVY
1331 Hale St.
Philadelphia PA 19111

I am looking for a copy of the tube chart and updating information for the B & K Precision Model 650 tube tester. I will pay postage both ways so that I can photocopy it.

Larry Schuldt
545 Willow Rd.
Marengo IL 60152

I need instructions for rewiring a standard 6-button telephone keyset so that it can be used with a Western Electric (Ma Bell) 212A modem. I will pay reasonable copying costs and postage.

Doug Ranz N8CDX
PO Box 1425
Warren MI 48090

I have a Jackson Electrical oscilloscope. If I can borrow either the complete manual (instruction) or schematic for Xeroxing, I will return and pay all postage.

Peter Dal Corobbo
18650 Marshall Ave.
Homewood IL 60430

I am looking for manuals/schematics for the following:

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- Cleaver Company Model 33A electronic keyer
- Boehme 5C frequency shift converter
- Acton Labs, Inc., Model #810 VTVM

I am also looking for any modifications to improve the Ten-Tec Argonaut 505 transceiver, especially for vfo stability and receiver sensitivity. I will gladly reimburse copying/mailing costs.

Gary Kohtala WA7NTF
S & F Co., USAISD, Box 918
Ft. Devens MA 01433

I would like to buy a National NCX-A ac power supply.

Gary Jones
PO Box 26313
Houston TX 77207

I need help in obtaining a replacement nicad pack for a Wilson Mark IV 4-Watt, 2-meter hand-held transceiver.

W.A. Lieseke WB7PUP
426 Bremerton Blvd.
Bremerton WA 98312

I need an operating manual/schematic for a Dumont Labs cathode-ray oscillograph, type #208. Costs paid.

Glenn Churchill KA2IOI
21 Bay St.
Glens Falls NY 12801

I would like to modify my Sony ICF-6800W to contain a noise blanker and to receive on longwave. I would like to locate some hardware or technical information concerning these modifications.

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2135 South Union Ave.
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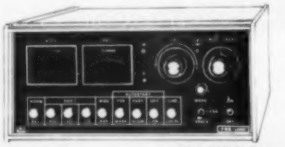

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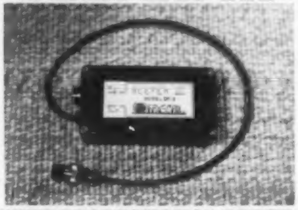

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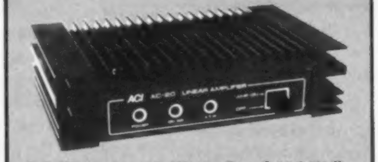

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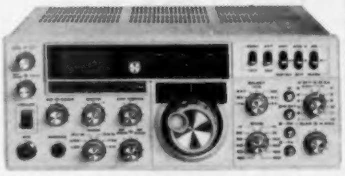

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

found Haiti. The Bahamas are treacherous, so we were very lucky not to run onto any of the thousands of shoals and reefs.

Exhausted by the storm, we found a protected bay and anchored to rest. A couple of hours later, we awoke to find ourselves at gunpoint—faced by a bunch of excited Haitians who had sneaked aboard our ship. They spoke no English and no one in our group spoke any French . . . except me. I quickly started trying to remember what I could of my high school French, twenty years unused and mostly forgotten. The menacing guns prompted my memory.

It turned out that these were police from nearby Mole St. Nicholas. They were convinced that they had captured a bunch of invaders bent on taking over Haiti and were looking forward to a good deal of publicity and perhaps rewards from the government. The idea died hard, but I finally convinced them that we were a scientific team. How could I ever explain to these simple people that we were hams bent on visiting a deserted island to set up a radio station for *fun*?

We visited the town. Have you ever visited a place where the average income is about $50 per year? Some of our welfare customers should have a chance to see what real poverty can be!

From there we sailed across to Navassa and looked it over. Hmmm. Formidable. Just one place to get up the cliffs which completely surround the island . . . and that via a wire rope ladder, with the waves shoving your boat into the undercut cliffs where it would be instantly shredded. We went back to Haiti to rent some Haitians and a small boat so we could get the ham gear onto the island.

At Cape Dame Marie, I once again managed to remember enough French to get the help we needed . . . and make the bargain. The head of the village made the bargain and gave us two Haitians and a boat. We found out later that he had no intention of giving the two chaps one cent of the pay. We towed the boat with the Haitians behind our ship back to Navassa. On the way one of them managed to fall overboard. Luck was with us and one of our group was looking that way when it happened so we were able to stop and circle around to pick him up. Damned fool couldn't swim and he was thrashing around, which attracts sharks. He wouldn't have lasted ten minutes.

With the help of the Haitians we got all of our ham gear from the boat to the top of the cliff. I'm afraid that *we* had to do most of the work. It was hot and dry. The damned island is covered with cactus and a wide variety of bushes with burrs. They seem to jump out at you if you even get close to them.

We set up two stations, one right at the top of the cliff and the other a couple hundred feet away. We had an enormous gas-driven power generator, two complete towers with beams, and rotors. We spared no expense to be well equipped. Our main receiver was a Drake 1A, a sideband (and CW) only receiver. That was a new way to go back in the early days of sideband.

The ship headed back to Haiti after leaving us off, scheduled to return for us in a few days . . . we hoped. Soon after the ship left, we found that we had a little problem. Oh, the rigs worked fine, but the heat was merciless and we found that our water supply was zilch. It turned out that the 50 gallons of water we'd brought had been in a rusty drum and had all leaked out on the trip down. Chet had noticed this and solved the problem by not bothering to bring the drum with us to the island. So we were faced with several days without water on this tropical desert island.

A couple of us explored the island, hoping to find some water. At the very top of the island was a tower with a beacon light. It was powered by acetylene which was piped up from bottles kept in a small shed near the tiny bay where we had our ham rigs. We found the remains of a house where, in earlier days, a lighthouse keeper had lived. Digging down through the remains of the house we found a cistern under the rubble. It had quite a bit of slimy water still left in it . . . but water it was!

We brought the water down in cans and bottles and boiled it. After a day we got tired of the boiling procedure and decided to see if this was really necessary. Chet, who in many ways had managed to isolate himself from the rest of us, was chosen (without his knowledge) to be the guinea pig. We gave him the untreated water and waited to see if he would survive. He didn't seem to notice anything so we all switched to untreated water.

Navassa had not been active in many years so we had a ball on the air, knocking 'em off by the thousands. Talk about pileups!

When we were getting the equipment from the ship to the small boat and then from there up onto the island, some of the key beam antenna elements managed to slip out of the sling and fall into the water at the base of the cliff. I had my scuba tanks with me just in case of something like this, so I was elected to go after the lost aluminum.

It turned out that the water was only about 60 feet deep right there so I was able to surface dive and bring it all up. I can hold my breath for a minute or so and do pretty well in anything less than 75 feet without the scuba equipment . . . as long as it is just going down and then back up again. The many sharks and barracuda put the others off from much swimming. I tried to assure them that the fish were just curious and to ignore them, but I wasn't very convincing apparently.

Once the pileups ran down, we packed up and sailed back to Haiti where a couple of us left to fly home and back to business. Four of the group came back with the ham gear to Nassau. I eventually got back most of my ham gear, but never saw my two scuba tanks again.

I ran an article in *CQ* on the DXpedition, doctoring up the photo of the loading area and the cliff with a big "W2NSD" sign. This seemed better than the Coast Guard graffiti which was actually there. Later DXpeditions to Navassa brought paint planning to cover up my W2NSD with their calls. Not finding it, they painted their calls everywhere and made an awful mess.

I have a great 16mm color movie of the expedition which might be of interest some day. My slides were, unfortunately, out on loan to a ham club at the time I was fired from CQ, and I was never able to get them back.

In 1972, a group of hams from Atlanta decided to do a Navassa DXpedition trip and I got invited. The leader was Chaz Cone W4GKF, who also runs the yearly Atlanta Ham Festival and was recently involved with the new IBM microcomputer system.

This time we flew to Jamaica, where it was only an overnight boat trip to the island. Piece of cake.

The *Time* article was in error on a couple of minor points. The description of amateur radio as a burgeoning (to grow or develop rapidly) hobby is nice to read, but a bit optimistic. And I don't know how one makes mutton stew out of a goat. Goat stew, sure . . . and it can be delicious if you don't know the name of the goat involved.

They are right about one thing: DXpeditioning is exciting and fun. It *is* adventure and I guarantee that if you break loose and go on one, that you will never forget one single minute of the trip, no matter how long you live. There are not many adventures left like that in our protective (perhaps overprotective) world. Giving a few thousand hams a new country merely supports a branch of the hobby which is of questionable value—country chasing. Few hams in rare countries enjoy the pressures this forces on them, which leads to rare countries being even rarer . . . thwarting one of the basic values of amateur radio: international friendships.

Maybe we could set up a new rule which would *only* give country credit if you work a DXpedition.

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vation of China . . . perhaps you can take the time to break loose this fall and join me for a short trip to China. Ten of us went to Canton a little over a year ago and had an experience that none of us will ever forget.

This fall, starting in late October, there will be a tour of the electronics shows in Tokyo, Seoul, Taipei, and Hong Kong. From there we will go to Bejing for a couple of days and then on around to other electronics shows in Munich and London. Yep, this trip not only will get you into the most interesting places in Asia, including Peking, but is an around-the-world tour.

In general, the tour allows a couple of days for each electronics show and then one for travel, which means that the seven-city tour takes about three weeks. The cost is around $4,000 and that includes first-class hotels, all transportation, and perhaps more meals than you may be able to handle. Some of the meals on these tours are spectacular.

At the shows you get to see the latest in consumer electronic equipment, small computers, and so on. We'll be meeting hams, of course. If you are in electronics you may find some products to import, some firms which want your products, or firms to make things for you. These shows are about the only practical way to reach the smaller businessmen in Asia.

If you're interested in racking up some memories for a lifetime, drop me a note and I'll see that you get the dope on the tour. I've been on it twice now and find it first rate.

AN ARRL RESPONSIBILITY

Many years ago, an amateur organization was formed for the main purpose of providing lobbying for the hobby and for funding legal fights against laws which would be seriously harmful to the hobby. The League spent a fortune to put that new organization out of business, fearing any rivals . . . even for purposes for which they were not responsible.

Okay . . . this, to my mind, puts some responsibility on their shoulders to stand up and fight when restrictive laws are passed which are harmful to amateur radio. A case in point is a recent ordinance passed by the city of Burbank, Illinois . . . and this one is hard to believe.

Firstly, they just recently passed a one-year moratorium on issuing any permits for amateur antennas. Secondly, there is an $11 yearly fee for the inspection of each antenna, with a $10 follow-up fee if the antenna does not pass inspection and has to be reinspected.

Even antennas already in place must be registered, with a lot of legal details plus a proof of bond, proof of insurance on the antenna, proof of inspections, and so on. The bond, by the way, requires those responsible for the installation to put up $5,000 which is kept by the city. The wording of the ordinance could be construed to force any amateur putting up his own antenna to put up this $5,000 bond.

NEWSLETTER OF THE MONTH

This month marks the 12th part of *73*'s Newsletter of the Month series. It seems appropriate to close the first year of the contest by reviewing our eleven winners.—N8RK.

73's August, 1981, pick was the Richardson Wireless Klub's *Chawed Rag*. We appreciated their decision to cover upcoming club activities rather than the minute details of what went on at the last club meeting.

September's choice, *The Birmingham Amateur Radio Club Newsletter*, offered some good technical information. They included details about a simple RTTY station as well as featured a monthly "Technical Corner" in which real-life problems were discussed.

The October winner came from the San Diego Repeater Association. *Squelch Tales* boasts several pages of paid advertising each month. This defrays the publication costs, leaving the club's resources available for other projects.

The name *Squelch Tale* (this time with no "s") popped up again in November. We applauded the Chicago FM Club for their newsletter's eye-catching appearance: a consistent, clean-looking layout that ensures readers will spend some time with each issue.

Rounding out the 1981 winners was *The Scuttlebutt*, published by the Yankee Clipper Contest Club. The Clippers leave no stone unturned in a quest for club members who can provide connections to keep the cost of producing the *Scuttlebutt* to a minimum.

The Wheaton Community Radio Amateurs' *The Hamletter* caught our eye in January, 1982, with its two-color printing job and large number of black and white photos. *The Hamletter* masthead gives more than a list of officers; you'll also find details about when the club meets each month and where to look for the local repeaters and nets. These kinds of details make a newsletter friendly and helpful to new readers.

Humor was a key feature in the February winner, *The National Hampoon*. This publication of the Cleveland-based South East Amateur Radio Club relates a lot of information about the doings of individual members in a good-natured, fun way.

A statewide organization, the Wisconsin Association of Repeaters, was recognized for its newsletter in the March, 1982, issue of *73*. Our judges said, "A newsletter editor needs to keep in mind the audience he is trying to reach; if he gives his specialized audience the specialized information that they joined together to learn, they will be happy both with the newsletter and the club."

April's pick, the Metroplex Amateur Radio Communications Association newsletter, was recognized for its beautiful layout. This publication is another example of utilizing the talents of your club members—the editor is a commercial artist.

The May winner, *Kansas Amateur Radio*, is a good example of the fact that a publication doesn't always need the backing of a club. This statewide newsletter is a nonprofit venture that relies on readers for financial and editorial support. The result is very impressive.

Rounding out the first year of *73*'s Newsletter of the Month Contest was *The Log*, published by the Northern Ohio Amateur Radio Society. *The Log* includes something for everyone: reports for awards chasers, the contest crowd, DX hounds, traffic handlers and Novices.

The real capper is the last part of the law which makes it illegal to cause any interference to radios, televisions, musical instruments, hi-fis, and so on. The fine set for this is a minimum of $25 and a maximum of $1,000 for each offense.

This sort of mischief *must* be fought. If it is permitted to stand in one city we can only expect it to proliferate, with each city pointing to the previous ones for legitimacy of the law. Yet fighting laws such as this, which seem silly, but which *are* laws, is an expensive undertaking. Who is going to pay to fight these laws?

I realize that there are a lot of amateurs who believe that *any* law must be obeyed and that it is un-American to even try to fight laws, good or bad. The fact is that there are a lot of really bad laws around and we either have to fight them or else give up more and more of our freedom.

You know, these same television viewers who gang up to force hams off the air will be the first ones to be screaming for ham communications when an emergency strikes. Speaking of emergency communications, the more we can organize this aspect of amateur radio, the stronger case we'll have when we have to deal with idiots such as the ones who put through the Burbank ordinance. Trying to reason with them as mere hobbyists trying to enjoy our hobby won't cut a lot of mustard.

It's funny about our laws. There has been a lot of fuss lately about driving and drinking, yet the courts seem to be fighting the laws and doing all they can to make sure that these drunken turkeys are back in cars again. We had one up here who had a record of drunk driving . . . and being let loose. He got soused one night, got behind the wheel . . . turned his truck over . . . some people helped him turn it back again and he went on a few minutes later to wipe out three kids when he drove over the line into their lane. The police gave him a drunk meter test, but the court wouldn't allow the results to be mentioned in the trial. And so it goes with laws.

As far as crazy laws are concerned, we need to keep our eyes out for them and make sure that the ARRL, our *only* national club, is held responsible for our protection. Remember that they are our *only* club because they have spent the money it took to shoot down all the others. I'm not pot-shotting the League—only pointing out the facts and the responsibilities which we, as members, have to hold them to.

GENERAL NOTES

Every now and then a reader writes in with indignation that he (or she, rarely) has written me a letter and I have not personally answered. First, let me assure you that I do, indeed, read my mail. If you write to me, I will get the letter. The odds are not so good that you will get an answer, for the simple reason that I am but one person and you, the reader, are one of about 750,000 who read my magazines each month. You get the picture?

The average magazine editor writes a paragraph or two a month, an exercise not likely to get many readers fired up into a letter-writing frenzy. My extended editorials in five monthly magazines seem to flip the more delicately balanced (unbalanced?) readers into an ennui which is only surmounted by a long letter to Wayne...some enthusiastic and others vituperative. I seem to have a halo when viewed from some angles and distinct horns from others.

The fact is that I am someone who is trying mightily to make up for a deprived childhood. I really wanted to get a small printing press when I was a kid and have been taking out the resulting frustration on a growing number of not very innocent bystanders. I've got one now and I am having a ball.

Mind you, whether I can answer or not, I *do* want to hear from you. If you have anything to tell me about some of my editorials, I am always open to more data. Emotional reactions? No. Reasoned arguments? Sure. And if you run into newspaper or magazine clippings I might have missed, I would really appreciate getting them. You probably already know about my interests, such as anything to do with amateur radio, microcomputers, education, UFOs, radar, TVRO... things like that.

If you have a subscription problem, I'm sympathetic but almost as helpless as you are. Send word of your problem to *73* Subscription Dept., Box 931, Farmingdale NY 11737, and give *all* of the details. If this manages to fail to help after about six weeks, the next step is to write to the Circulation Manager, *73 Magazine*, Peterborough NH 03458. If that doesn't get action, try General Manager Debra Boudrieau, Wayne Green, Inc., 80 Pine Street, Peterborough NH 03458. If that, too, fails, let me know and I will rattle the chains.

If you need a back issue, try your best to identify it. We don't have a staff sitting around ready to try to find articles via a clue or two. Check our yearly index for hints. Check our Radio Bookshop for back issue prices... if we have the issues.

We have just enough people here to barely get the magazine out each month, so there is no one sitting around to give technical help or to design circuits for you. If you do have a question, please send it to the Technical Editor, *73 Magazine*, Peterborough NH 03458, complete with an SASE...and then hope that he gets some time. For the most part, you want to try to deal with the author of an article, remembering that he, too, may be up to here in trying to keep up with correspondence. It is not unusual for an author to get a thousand letters after a particularly interesting article. Now, how is he going to handle all of that?

ARTICLES

In the main, we are looking for construction projects. I have this bee in my bonnet about getting hams into building again, even if I have to drag them kicking and screaming into it...as I did with FM and repeaters. Boy! Did the readers hate FM when I started with *that*!

Articles are simple to write. You must type them in upper- and lowercase characters. You must double-space and leave generous margins on the pages for editing. We are now able to accept articles written on your TRS-80 I and III. Send in both the disk and a double-spaced printout. Then we will be able to do the editing on the printout and update the disk, finally dumping the edited article from the disk directly into our typesetting system. That will speed things up for us substantially.

We're also looking for articles which may help encourage schools to set up ham clubs. I feel that the future of both amateur radio and the technology of our country depends on this development.

Photos are most helpful in making the article interesting for the readers. If you have built a gadget and are not equipped with a first-rate camera, please send in the unit so that we can shoot it. We have a Mamiya RB-67 and can do a professional job. No more fuzzy Polaroids, okay? It takes a large-format camera and good lighting to turn out a good photo.

One more thing: Don't ever, ever send your article to two magazines at the same time.

THE PHONE

My apologies to readers wanting to get through to me on the phone. What with trying to manage six monthly publications, nine separate divisions of the company, do consulting, get to shows, give talks, keep up with the literature in two fields, and even ham a bit, my time even for telephone calls is very limited. This means it is getting more and more difficult to break through to me. But if I don't do that, I won't keep all these things growing...or be able to write all these editorials (*no smart remarks*).

In general, if my calendar permits, I'm available for talks to groups at $1,000 plus expenses for Sherry and me. Consulting runs about $500 a day plus expenses for the two of us, whether it is worth it or not. The same goes for the talks. The steep prices make it so that I have more time to do my work ...though I've had no complaints as yet.

CORRECTIONS

In the review of the CES 635 Microdialer (May, 1982, p. 138), we stated an incorrect price. The correct price for this microphone is $99.95.

Jeff DeTray WB8BTH
***73 Magazine* Staff**

In the April issue, page 10, the article "Watching the Weather" will undoubtedly interest many hams having the old deskfax in their parts closet.

There is, however, one portion of the layout which in my opinion can be simplified and possibly be made less expensive. This involves the need to reduce the drum rpm from 180 to 120 which, in the article, requires a 40-Hz voltage amplifier. The same rpm requirement can be met by leaving the motor as a straight 120-volt, 60-cycle unit and changing the output gearing.

Standard gear catalog listings do not show a 1.0-inch-center distance with the required 30 to 1 ratio. I guess nothing in our hobby comes easy, and a little work is required. There is, however, a gear set which comes close to the 1.0-inch-center distance spacing and the exact ratio.

The data are as follows:

- Worm Gear—32 diametral pitch, face width 7/32, bore: .25 diameter, hub diameter 11/16, projection 5/16, 60 teeth, 1.875 PD; catalog #D-1132, item code 13514.
- Worm—32 diametral pitch (double thread), PD .438, bore 3/16; LTHB item code 12922.

- Source—local industrial distributor handling Boston Gears. The manufacturer is Boston Gear Division, 14 Hayward St., Quincy MA 02171, (617)-328-3300.

Since the center distance will now be 1.156 inches with the new gears instead of the original 1.0 inch, it becomes an easy job with the help of a drill motor and a half-round file to lower the motor 5/32 of an inch. The worm will fit as is, but a new pin hole may have to be drilled. The worm gear must be reworked from a .250-diameter center hole to a .500 diameter. Once installed, the standard input of 120 volts at 60 Hz will drive the drum at 120 rpm.

This will eliminate the 80-kHz oscillator, the divider chain, the 40-Watt amplifier, and, of course, the autotransformer.

John Watzke K8OXI
9910 Shore Drive
Pigeon MI 48755

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

THE POSTMAN RETURNS

From Guam to Austria, Alaska to Florida, hams from all over the globe responded to the 1982 edition of the annual Fun! poll. The results, as always, were fascinating, and I wish to thank everyone who participated. I also want to thank my postman, who once again risked his back delivering all those envelopes.

Frankly, what always astounds me about this poll is not only the number of people who take the time to fill out a rather lengthy questionnaire, but also the number who write very long and generally thoughtful letters. Amateur radio will always be a vital hobby as long as there are people around who care about its future.

So thanks once again to the 1,016 of you who wrote in. Here's what you had to say.

ELEMENT 1—BACKGROUND

1) Sex:
A) Male—91% B) Female—9%
A three percent increase in the number of female amateurs over last year. An encouraging trend, but not conclusive enough to indicate a real trend.

2) Age:
A) 15 or below—5% B) 16-21—6% C) 22-39—49% D) 40-59—27% E) 60 and above—13%
Not very encouraging for our hobby's future.

3) License class:
A) Novice—6% B) Technician—10% C) General—30% D) Advanced—40% E) Extra—14%
Compared to last year, seems like there's been an upswing in upgrading.

4) Number of years licensed:
A) 1 year or less—4% B) 1-5 years—33% C) 6-10 years—8% D) 11-20 years—29% E) 21 years and up—26%
The old-timers reign.

5) Do you have a new (post-March '78) call?
A) Yes—45% B) No—55%
The new calls have an 8% increase over last year.

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour—5% B) 2-5 hours—29% C) 6-10 hours—44% D) 11-20 hours—16% E) 21 or more hours—6%
About the same statistics as last year.

7) Which HF band do you most use?
A) 80-75 meters—15% B) 40 meters—20% C) 20 meters—21% D) 15 and/or 10 meters—35% E) Don't operate HF—9%
As the sunspots diminish, so does 15- and 10-meter operation—down from 43% last year.

8) Which VHF-UHF band do you most use?
A) 6 meters—3% B) 2 meters—71% C) 220 MHz—6% D) 420 MHz and/or up—1% E) Don't operate VHF-UHF—19%
Spread out, guys!

9) Which mode do you most use?
A) SSB—41% B) CW—20% C) FM—30% D) RTTY—5% E) Other—4%
If CW is so great, why does its popularity keep dropping?

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenditures.)
A) $0-$250—39% B) $251-$500—30% C) $501-$1,000—24% D) $1,001-$2,500—4% E) $2,501 and up—3%
A continued downward trend.

ELEMENT 2—SOCIAL CHARACTERISTICS

11) Has amateur radio influenced your career choice?
A) Greatly—25% B) Somewhat—26% C) Not at all—49%
Quite an impressive statistic, really.

12) Do you answer QSLs with no return postage?
A) Yes—76% B) No—24%
The fact that the word "Novice" was eliminated from this question, plus two postage increases, might account for the 20% positive response drop.

13) Politically, how would you define yourself?
A) Conservative—40% B) Middle-of-the-road—51% C) Liberal—9%
I've always felt hams were a pretty conservative lot, and it looks like my suspicions were correct. Being a C person, I feel pretty lonely.

14) Do you think amateur radio will exist 20 years from now?
A) Yes—87% B) No—13%
Hams are a pretty optimistic lot.

15) Have you ever had a fight with a family member over amateur radio?
A) Yes—71% B) No—29%
Wow! I want the first aid concession at the next hamfest.

16) Do you have any relatives who are hams?
A) Yes—49% B) No—51%

17) Are most of your friends (more than half) hams?
A) Yes—40% B) No—60%
Takes one to know one—almost.

18) Did you ever use a "cheat book" (not counting the ARRL *License Manual*) to upgrade your license?
A) Yes—16% B) No—84%
No comment.

19) If someone offered you five million dollars, tax-free, on the condition that you give up amateur radio forever, would you?
A) Yes—81% B) No—19%
We raised the ante by four million over last year and got 20% more takers. As for the other 19%, I still say every man has his price. How about 10 million?

20) Do you belong to a local ham radio club?
A) Yes—45% B) No—55%
Not good enough.

21) Have you ever attended a ham flea market?
A) Yes—79% B) No—21%
If you haven't, you don't know what you're missing.

22) Have you ever attended the Dayton Hamvention?
A) Yes—24% B) No—76%
I haven't made it since 1978, but it was a gas!

23) Would you pay five dollars to join the ARRL if they offered no magazine, QSL services, awards, or technical and instructional help?
A) Yes—22% B) No—78%
Guess it must be that great magazine that makes the League. I, for one, love to regale my friends on 15 with the latest activity reports.

24) Would you like to see another national organization compete with the ARRL?
A) Yes—22% B) No—78%
Hoo boy! Did I raise a hornet's nest with this one. One respondent even went so far as to call me a rabble-rouser. I take no stand on this question, but judging from the results, I certainly wouldn't invest my money in the stock of a competitor.

ELEMENT 3—OPERATING HABITS

25) Would you favor a licensing system that had only two classes: Novice and General or Communicator and General?

A) Yes—58% B) No—42%

So much for incentive licensing.

26) Would you like to see the FCC turn over amateur testing responsibility to clubs?

A) Yes—61% B) No—39%

Many of those who were against were afraid of abuses.

27) Do you think religious and politically-oriented nets have a place in ham radio?

A) Yes—79% B) No—21%

Hey, you guys who picked B. Haven't you ever heard of free speech?

28) Should contests be outlawed?

A) Yes—31% B) No—69%

Emotions ran hot and heavy on this one.

29) Do you think the FCC should assign exclusive frequencies and times to nets?

A) Yes—7% B) No—93%

Not a very attractive proposition.

30) Do you think the FCC should assign exclusive frequencies to repeaters?

A) Yes—20% B) No—80%

I don't like the idea, either.

31) Should there be a no-code, VHF and above, "Digital class" license? This license would require a heavy theory test and carry no phone or CW privileges (except perhaps for ID purposes).

A) Yes—34% B) No—66%

I can't figure it: Some letters were downright hostile to the influx of computer users on the bands, as if they were taking over the hobby. Many respondents seemed to welcome the digital ticket idea, but not enough to make a majority.

32) Should there be a no-code 220-MHz, "Communicator class" license? This license would require a moderately difficult theory test and carry only F3 privileges at a maximum of 50 Watts.

A) Yes—41% B) No—59%

A hard core of respondents seemed to be against dropping the code test for any type of license.

33) Do you own a microcomputer?

A) Yes—39% B) No—61%

I can't see how a technically-inclined person can be without one.

34) What sort of CW sending device do you most often use?

A) Straight key—56% B) Keyer—25% C) Bug—4% D) Keyboard—6% E) Never operate CW—9%

Last year, I accidentally left out bugs and received scores of letters asking why. This year, I insert the classification and find out only 4% use them. Can't win.

35) If required, could you solidly copy CW at the speed at which you were licensed?

A) Yes—75% B) No—25%

Compared with last year, our skills are diminishing.

36) Have you ever purposely operated in an amateur subband you weren't licensed to use?

A) Yes—11% B) No—89%

About the same as last year.

37) Do you think the FCC affects amateur radio in a positive manner?

A) Yes—48% B) No—52%

A little more positive than last year.

38) Do you ever speak to foreign, non-English-speaking hams in their own language?

A) Always—3% B) Sometimes—15% C) I attempt it—25% D) Rarely—6% E) Never—51%

No substantial change over last year.

39) Do you feel yourself competent to replace the finals in a tube-type rig?

A) Yes—91% B) No—9%

Does anyone still own a tube rig? Only kidding!

40) Do you feel yourself competent to replace the finals in a transistor-type rig?

A) Yes—80% B) No—20%

A soldering iron? I thought it was an electric cigar!

41) Have you ever built an electronic project from a kit?

A) Yes—98% B) No—2%

A ham isn't a ham unless he's unpacked all of those little brown bags before opening the instruction booklet.

42) Have you ever "home-brewed" an electronic project from a book or magazine?

A) Yes—75% B) No—25%

A bit down from last year. For shame on those who haven't.

43) Have you ever designed your own electronic project?

A) Yes—61% B) No—39%

Hasn't everyone?

44) What do you think of contesting?

A) Great—15% B) Good—20% C) Okay—17% D) Don't like it—29% E) Despise it—19%

You're 59 New York.

45) What do you think of DXing?

A) Great—40% B) Good—31% C) Okay—19% D) Don't like it—5% E) Despise it—5%

QSL via the bureau.

46) What do you think of repeaters?

A) Great—35% B) Good—30% C) Okay—22% D) Don't like them—8% E) Despise them—5%

Wait for the beep.

47) What do you think of traffic handling?

A) Great—10% B) Good—35% C) Okay—40% D) Don't like it—14% E) Despise it—1%

48) Do you plan to use Phase III OSCAR within a year of its launch?

A) Yes—28% B) No—72%

Looks like that passband is going to get pretty crowded.

49) Do you plan to use the new 10.1-MHz band within one year of its opening?

A) Yes—40% B) No—60%

That should be around Jan. 1, 2065, at the rate the U.S. Senate is moving.

50) Do you believe amateurs should have the right to build, use, and sell equipment for the reception of subscription television?

A) Yes—24% B) No—76%

I should have left "sell" out of the question. Seems many amateurs think they should be able to pirate signals for their own use, but not for others.

SELECTED COMMENTS

Too many private repeaters tying up amateur frequencies. Some systems have only three people on them.—KB6BO.

Morse code should be outlawed as a requirement, although I love it.—K6XR.

Amateur radio needs quality, not quantity. We should strive to keep the standards high.—WB5ZDP.

We will keyboard and computerize ourselves away from the human fashion of hamming.—W4YDL.

Let's have more polls—these are FUN!!—KF4W.

I think the Communicator class is a very good idea. I am partially deaf. Code is very hard for me. This may give deaf people a chance to communicate by RTTY.—KA7CYE.

After 21 years of hamming, I earned my Extra class license and not a word of congratulations from the ARRL or any manufacturer of ham gear.—KD1J.

This has been the only column you've put in print that I knew all the answers to.—N7AVM.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CANADA CONTEST

Starts: 0000 GMT July 1
Ends: 2400 GMT July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs, and everybody works everybody. Entry classes include single operator/all bands, single operator/single band, and multi-operator/single transmitter/all bands. There are separate single-operator QRP (5 W dc, 10 W PEP out) and single-operator non-Advanced amateur classes.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts, and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001; VE1 stations should also send their province (NS, NB, PEI).

SCORING:

Score 10 points for each contact with Canada, 1 point for contacts with others. VE0 counts as Canada. Score 10 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers). Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

Phone—1810, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50.1, 146.52.

CW—1810, 3525, 7025, 14025, 21025, 28025, 50.1, 144.1.

Suggest phone on the even hours (GMT), CW on the odd hours (GMT). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

A plaque will be awarded to the highest score single operator/all bands entry. Certificates will be awarded to the highest score in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check lists are available. Entries should be mailed within one month of the contest, with your comments, to: CARF, PO Box 2172, Stn. D, Ottawa, Ontario K1P 5W4, Canada.

Results will be published in *TCA*, the Canadian amateur magazine. Non-subscribers may include an SASE for a copy of the results.

CALENDAR

Jul 1	**CARF Canada Day Contest**
Jul 10-11	**IARU Radiosport**
Jul 17-18	**International QRP Contest**
Jul 17-18	***A5 Magazine* Worldwide SSTV DX Contest**
Jul 24-26	**CW County Hunters Contest**
Aug 7-8	**ARRL UHF Contest**
Aug 14-15	**European DX Contest—CW**
Aug 14-16	**New Jersey QSO Party**
Aug 21-22	**SARTG Worldwide RTTY Contest**
Aug 21-22	***A5 Magazine* FSTV UHF Contest**
Aug 28-29	**Occupation Contest**
Sep 11-12	**ARRL VHF QSO Party**
Sep 11-12	**European DX Contest—Phone**
Sep 11-12	**Cray Valley RS SWL Contest**
Sep 18-20	**Washington State QSO Party**
Oct 2-3	**California QSO Party**
Oct 16-17	**ARCI QRP CW QSO Party**
Oct 16-17	**Pennsylvania QSO Party**
Nov 6-7	**ARRL Sweepstakes—CW**
Nov 13-14	**European DX Contest—RTTY**
Nov 20-21	**ARRL Sweepstakes—Phone**
Dec 4-5	**ARRL 160-Meter Contest**
Dec 11-12	**ARRL 10-Meter Contest**
Dec 19	**CARF Canada Contest**

INTERNATIONAL QRP CONTEST

Starts: 1500 GMT July 17
Ends: 1500 GMT July 18

The first International QRP Contest is being sponsored by the World QRP Federation (WQF) and offers a variety of awards for leading stations. This is a CW-only event with separate categories for single- or multi-operator stations, and for those operating fixed or portable. Multi-operator stations may be on the air for the entire 24-hour contest period, while single-operator entries must be off the air for at least an eight-hour period. All stations may be worked once per band for QSO and multiplier credits.

EXCHANGES:

RST, QSO serial number, and class (599 001/2D). Add X after RST if crystal-controlled (559X 001/2D).

FREQUENCIES:

The traditional QRP frequencies will be utilized: 1810, 3560, 14060, 21060, and 28060, all plus or minus QRM.

OPERATING CLASSES:

1 = single operator, 2 = multi-operator, A = fixed station up to 2 Watts input or 1 Watt output, B = fixed station up to 10 Watts input or 5 Watts output, C = portable station up to 2 Watts input or 1 Watt output, D = portable station up to 10 Watts input or 5 Watts output, and E = QRO stations of more than 10 Watts input or 5 Watts output.

SCORING:

Count 1 point for QRP to QRO contacts, 2 points for QRP to QRP. For multipliers, count 1 if both stations are in the same country, 2 if the other station is in another country on the same continent, 3 if the other station is in another country and on another continent. For scoring purposes, all call areas within a country are counted as multipliers (e.g., 10 for W/K, 8 for VE, 10 for PY, etc.). For crystal stations with a maximum of three crystals per band, QSO and multiplier points are doubled. Contacts with crystal-controlled stations count double. Band points are the QSO points per band times the multiplier points per band. Final score is the sum of band points from each band.

AWARDS:

DL-AGCW will provide awards for fixed station leaders and band leaders. QRP ARCI will provide plaques to the first place single- and multi-operator portable stations worldwide plus certificates for the multiple- and single-operator portable station in each country with two or more entries.

ENTRIES:

Send logs within six weeks of conclusion of the contest as follows: fixed stations to Siegfried Hari DK9FN, Spessartstrasse 80, D-6453 Seligenstadt, West Germany; portable stations to William W. Dickerson WA2JOC, 352 Crampton Drive, Monroe MI 48161, USA.

INTERNATIONAL WORLDWIDE DX SSTV CONTEST

Starts: 0000 GMT July 17
Ends: 2400 GMT July 18

This is the second annual DX SSTV contest sponsored by *A5 ATV Magazine*. This is a 48-hour SSTV video contest using 80 through 10 meters within the recommended SSTV calling/operating frequencies listed below. To encourage use of all bands, extra bonus points are granted on the 10-, 15-, 40-, and 80-meter band segments. Single- and multi-operator stations are recognized with crossband contacts not permitted. Individual contacts count only once per band with repetitive multi-band contacts acceptable.

Callsigns and video reports must be in "video" form. Mugshots of the station operator, family, or friends can count only once. Slower clock-rate speeds are encouraged in either 128/16.5-second or 256/31-second timebases. Color work must contain a minimum of 2-color overlay to qualify with standard RGB frame transmissions. Motion SSTV must have a minimum of 2 frames sent with automatic-receive switching circuitry or manually operated switching by the receiving operator, and 64 × 64 "quadrant" storage of no less than 4 separate pictures with replays.

SCORING:

Each SSTV two-way contact is worth 5 points within the same country and 10 points for DX out-of-country. Contact bonus points are available as follows: mugshots—1 point, slow speed—2 points, quad frame—3 points, motion SSTV—4 points, high resolution—5 points, and color SSTV—10 points.

A band multiplier of 3 can be claimed for contacts on 40 and 80 meters, and 2 for contacts on 10 and 15 meters. Stations with over 25 DX countries worked—add 25 points, 50 DX countries—add 50 points, and over 100 DX countries—add 100 points!

FREQUENCIES:

Advanced/Extra—3845, 7220, 14230, 21340, 28680, 50.150.

General—3990, 7290, 14340, 21440, 28680, 50.150.

AWARDS:

First-place winner receives 3-year subscription (worth $60) to *A5 ATV Magazine* with front-cover picture plus a Gold Certificate. Second- and third-place winners receive one-year subscriptions and Gold Certificates. All entries regardless of score receive Gold Certificates suitable for framing. Results will be in the November issue of *A5 ATV Magazine*.

ENTRIES:

Submission of logs and totaled scores must be postmarked no later than August 1st and submitted to: Contest Manager, *A5 ATV Magazine*, PO Box H, Lowden IA 52255-0408. Logs will be returned as will any photos, etc. Some log sheets and DX country lists are available from WB0QCD.

RESULTS

1981 PENNSYLVANIA QSO PARTY
(QSOs and Score)

Top Seven—Eastern PA

WB3DJF	748	97,216
K3ONW	543	79,401
AA3B	570	77,166
KC3N	559	76,328
K3NB	539	72,200
N3AMK	568	70,437
AI3Q	491	57,684

Top Seven—Western PA

AD8J/3	502	62,628
N3BBH/3	580	51,216
KA3BFX	398	45,177
KA3FMH	382	42,864
WB3IET/3	396	40,788
AG3H	250	38,500
N3BMV	390	37,536

Out of State—Top Ten

AE3Y	311	23,072
VE3BR	234	18,467
K2POF	166	11,500
W2IMO	171	11,398
K9GDF	170	10,951
K1BV	156	8,677
W1DWA	128	7,943
W2EZ	110	7,755
N2CIW	142	7,384
N4FAI	110	6,750

Multi-Operator

K3ZUF	1384	194,207
KB3S	526	73,593
K3CR	583	70,750
AG3R	417	52,781
KB3NQ	369	35,424
KA3DXR	247	22,244
W3YA	102	6,075
Ctr.Co. EOC (WB3AEI,WB3DVH,WN3VAW)	31	819

Mobiles

WA3QNT/m	269	24,157
		(from 9 counties)
K3BS/m	327	19,293
		(from 18 counties)
N2BLT/m	104	4,368
		(from 6 counties)

Check log:

W3HDH/m	433	39,849
		(from 15 counties)

Clubs

Clubs	Location	Score	Entries	Top Scorer
Penn Wireless Association	Bucks County	425,570	16	WB3DJF
Erie Amateur Radio Association:	Erie	296,651	22	KA3BFX
Nittany Amateur Radio Club	State College	264,723	13	N3BBH
Delaware-Lehigh Amateur Radio Club:	Northampton Co.	217,510	8	K3ZUF
Hazleton Amateur Radio Club	Hazelton	161,728	11	AI3Q
Penn State University Radio Club	University Park	95,509	3	K3CR
Frankford Radio Club	Philadelphia	74,181	2	—
Mon-Valley Amateur Radio Association	Washington Co.	73,593	2	—
Murgas Amateur Radio Club	Luzerne County	63,399	6	WB3FYT
Carbon ARCs	Carbon County	61,739	4	WB3JZE
Point Radio Operating Society (PROS)	Allegheny Co.	36,231	2	—
Harrisburg Amateur Radio Club	Harrisburg	35,226	4	W3ADE
Reading Amateur Radio Club	Berks County	33,198	3	WA3JXW
Tioga County Amateur Radio Club	Tioga County	26,929	2	—
Mobile Sixers	Chester County	9,505	2	—

CW COUNTY HUNTERS CONTEST

Starts: 0000 GMT July 24
Ends: 0200 GMT July 26

The CW County Hunters Net invites all amateurs to participate in this year's contest. All mobile and portable operation in less-active counties is welcomed and encouraged. Stations may be worked once on each band, and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number; category (P for portable, M for mobile); RST; state, province, or country; and US county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier.

FREQUENCIES:

Frequencies are 3575, 7055, 14070, 21070, and 28070. It is strongly requested that only P or M category stations call CQ or QRZ on 40 meters below 7055 and on 20 meters below 14070, with all other stations spreading out above those frequencies.

SCORING:

QSOs with fixed stations are 1 point, QSOs with portable or mobile stations are 3 points. Multiply the number of QSO points times the number of US counties worked. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate, and calculate their score on all operation if they operated from more than one state in competition for the High Portable or High Mobile Trophy.

AWARDS:

Certificates will be awarded in three categories:

1) Highest fixed or fixed-portable station in each state, province, and country with 1,000 or more points.

2) Highest station in each state operating portable from a county which is not his normal point of operation, with 1,000 or more points.

3) Highest station in each state operating mobile from 3 or more counties with a minimum

RESULTS

RESULTS OF *A5 ATV MAGAZINE* WORKED ALL STATES SSTV CONTEST

(Full results appeared in the June issue of *A5 ATV Magazine*, PO Box H, Lowden IA 52255-0408.)

The top 5 entries from 59 entries received:

1st—Luis Chartarifsky XE1LCH
2nd—Roland Soucie N6WQ
3rd—Larry Benson K9KQO
4th—John Hudak III KA3X
5th—Harry Harchan W2GND

of 10 QSOs in at least each of 3 counties.

Trophies will be awarded to the highest single-operator station in the US in categories P and M. The Awards Committee may issue additional awards.

ENTRIES:

Logs must show category, date/time in GMT, station worked, band, exchanges, QSO points, location, and claimed score. All entries with 100 or more QSOs *must include a check sheet of counties worked or be disqualified from receiving awards.* Enclose a *large* SASE if results are desired. Logs must be postmarked by September 1st and sent to: CW County Hunters Net, c/o Jeffrey P. Bechner W9MSE, 673 Bruce Street, Fond du Lac WI 54935.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

CHINA

China. The very word conjures up visions of mystery and Marco Polo. And to DXers China means Number 1 on everyone's Most Wanted List. The *DX Bulletin* annual survey (the benchmark of the Most Wanted Lists) continues to show China in the top spot again this year.

Over the past few years, the China rumors have been flying thick and fast. "China will be opening soon." "Hundreds of China stations will start operating next week." And so on. One prominent New Zealand amateur came within inches of spurring China into the amateur radio arena, but his US citizenship sabotaged the effort.

The positive attitude of the China authorities encourages the rumors and rumor-followers. Unlike many countries where amateur radio is flatly prohibited, China has been enthusiastic about the future role of amateur radio. It is just a matter of time.

That time may have finally come. On March 29, BY1PK appeared on 15 meter CW, working (of course) JAs.

Tom Wong VE7BC clearly performs the role of hero in this operation. His tireless efforts over the past few years have just begun to provide fruit. Tom has been instrumental in funneling equipment, training materials, books, and expertise from the ARRL and other stateside organizations to the appropriate authorities in China.

The BY1PK operation represents not a one-shot, contest-style operation, but the reawakening of amateur radio in the most populated country in the world. Although China will move slowly in the amateur radio field, it is moving in the right direction, and the next few years should see that Number 1 ranking slip further and further down the Most Wanted survey.

The "Other" China

The neophyte DXer, unfamiliar with the prefix BY, might turn to the International Prefix Allocation List to locate the source of the signals. The list shows all the B callsigns as belonging to China. The *Callbook* shows no China amateurs. Or does it?

In addition to working on his monthly DX column for 73 Magazine, *Chod Harris VP2ML leads a very demanding life. Here he's shown slaving away at his VP2 QTH.*

Just before the BY listing in the *Callbook* is the BV listing: two amateurs. If the BY call signifies China, what does the BV signify? Answer: The "other" China—our former ally, Taiwan, the Republic of China.

Not to be confused with the People's Republic of China, Taiwan is the last refuge of the anti-Communist forces driven out of mainland China after World War II. The Nationalist government of Taiwan considers itself to be the legitimate authority over all of China, hence the BV callsign.

But only two amateurs in a country as rich and well populated as Taiwan? A small amateur population is more typical of a smaller, undeveloped country, a distinction hardly appropriate for industrial Taiwan. So why only two hams?

The question is not why there are only two amateurs in Taiwan, but rather why there are any amateurs at all. Taiwan considers itself still at war with the mainland government. Both sides would like the other to go away, to reunite the country (shades of Korea and Vietnam here). And military governments under states of war or emergency are notoriously reluctant to allow free use of the amateur bands.

One of the very first proclamations under the martial law in Poland was the crackdown on amateur radio activities. Even in the US, amateur radio activity ceases during wartime.

We can understand why a country at war would feel uncomfortable about permitting unrestricted use of the amateur bands. The independence of the amateurs and the tremendous flexibility of amateur equipment are powerful communications tools to those on the outs with the government.

The increasing use of amateur radio gear in illegal drug shipments demonstrates that ham radio equipment and expertise can be a disturbing factor in sensitive political differences. Hence many countries simply prohibit all amateur radio activities; witness Albania, for example.

So we return to our original question: Why is there any amateur radio activity at all from a divided country engaged in a "civil war"?

First, there is really only one amateur in Taiwan, with two callsigns: Tim Chen operates BV2A on CW and BV2B on SSB. Somehow a single individual has obtained permission to operate amateur radio in Taiwan. But that permission is probably the most restricted amateur radio authority short of a flat-out ban. Tim's operating authority restricts him to specified times and frequencies. Can you imagine your radio license specifying the exact frequency and time of operation? It would certainly put a crimp in your DXing.

Fortunately for DXers throughout the world, Tim maintains his activity, keeps to his schedules, and regularly provides QSLs from the "other" China.

Look for Tim Wednesdays between 1200 and 1600Z on one of the following frequencies: 14025, 14040, 14218, or 14250. Tim usually shows up on CW first and switches to SSB a little later. Tim also has operating permission Saturday from 2300 to 0200Z. When band conditions permit 15-meter operation, Tim operates on 21030, 21110, 21270, and 21350. And more recently Tim has added the 10-meter frequency of 28530 to the possibilities.

Tim QSLs consistently either direct to Box 101, Taipei, Taiwan, Republic of China, or via QSL manager K2CM at his *Callbook* address.

If you hear BV2B on 20 meters and have trouble breaking through the pileup, perhaps your choice of phonetics could use improvement. Let's continue our discussion from last month.

PHONETICS

Last month we discussed the different kinds of phonetic callsigns: standard, place names, and "cute" phonetics. Now we look at how you evaluate your own choice of phonetics and how you can select alternate phonetics.

A phonetic call should have two characteristics: The call must be unambiguous, and it should punch through the pileup. Removing ambiguity from a potential phonetic callsign is easy: Pick easily recognized words which have no common homophones (a word that *sounds* similar, but is spelled differently).

A couple of examples of what *not* to do might illustrate this: A W5 called me using "Motel" as a phonetic. The confusion between this and "Hotel" is obvious. And one Field Day, an amateur called me with the phonetic suffix, "Fuzzy Wuzzy Wabbit!" I was forced to ask for clarification: "Is that R as in Rabbit or W as in Wabbit?" Back came the reply, "Wabbit! Wabbit, wabbit, wabbit!" Memorable, but not very effective in a DX pileup. Stick with less confusing phonetics.

Selecting a phonetic call with punch is more difficult. I suggest going to a station equipped with an oscilloscope monitor of the outgoing signal. Try different phonetics and combinations of phonetics while watching the scope. Look for those phonetics which give the greatest average output, or the "blockiest" output pattern. Lacking a scope, try watching the relative power output meter on your rig. Again, try to keep the average power as high as possible.

The two "cute" phonetics mentioned last month (W1NoGood and WA9BlackWhiteYellow) are very effective because they share the two most important characteristics of good phonetics: They are unambiguous and they really cut through the pileups. Watch your output meter while saying "No Good" or "Black White Yellow" to see what a good phonetic does for your average output.

Also, individual amateurs in foreign countries might have a particular difficulty with one of your choices. For one reason or another, an amateur might have a block against that particular phonetic and fail to understand even under good conditions. Be flexible, and don't be afraid to shift to a backup set of phonetics when the first fails after a couple of tries. On the other hand, wait until the DX station is obviously struggling with the call before you switch your phonetics. You use phonetics to *reduce* ambiguity, and throwing dozens of different phonetics at the DX station will more likely confuse the poor DXer and decrease the chances for a successful contact. Keep your different phonetics to a minimum and use an alternate set only when necessary.

I found that three sets of phonetics covered almost any situation. A short, punchy set worked for good conditions, where I knew my call would get through, or for tailending: "Sugar Queen Baker." I tried a slightly longer set when the first one failed: "Sierra Quebec Bravo." This set had the advantage of very high average output; I could really hang the relative power output meter up with Number 2. The final set was the lousy condition set: "Santiago Quebec Bolivia," to be used only under adverse circumstances, when repetition of the other two failed miserably. I used this phonetic *after* contact was established. If the DX station did not have my call correctly, or continued to struggle with the call, I would switch to the longer phonetic.

Many amateurs use phonetics for the *suffix* of their call but ignore the *prefix*. When the only stateside calls began with K, W, WA, and WB, the possibilities for error remained small. But even the advent of WD calls rapidly discredited this practice. The current proliferation of similar sounding prefixes (KB, KD, KE) makes the use of phonetics for both prefix and suffix mandatory.

Testing Your Choice

The ideal way to test your phonetics is to get on the air and start throwing your call into pileups. Does the call get through? Do the DX stations get your call correctly? The best test of a given set of phonetics is success. If it works, try it again. If it works again and again, use it a lot. If it does not cut the pileup, try another combination until you find the most effective.

One sure sign that a given phonetic doesn't work for your combination of voice and station is a pattern of consistent error when the DX station comes back to you. For example, I quickly found that "Whiskey Alpha One Sierra Queen Bravo" was often answered with WA1S something B." Watching the output scope showed me the problem: Output dropped to near zero on the "Queen." That letter wasn't getting through. A switch to "Quebec" (although opening the door for confusion with Canadian stations) eliminated the lost letter phenomenon.

More Than One?

After experimenting in front of the output monitor (into a dummy load or empty band, of course) and testing the DX waters in numerous pileups, you will find a phonetic call which meets the requirements of lack of ambiguity and good penetrating power. You will be tempted to use this phonetic call in every DX circumstance. Unfortunately, life, and especially DXing, is not that simple. The best set of phonetics for one band or band conditions might not be competitive at another time. A short, snappy phonetic call might be just the thing for 10 meters when it is wide open, but the same combination on 80 might be destroyed by a single static crash.

Finally, phonetics are very personal. What works for one voice, rig, and microphone might not work for another combination. Guest operators at the big contest multi-multis are familiar with this problem. Each operator has to experiment to find the phonetics which work best. Meanwhile, see you in the pileups! Next month we'll have a treat for the CW DXers, as we examine zero-beating.

NOTES FROM ALL OVER

JO1CRA gives the following address for WH0AAB: Hide-haru Aimono, 2644 Tsuruda, Utsunomiya-City, Tochigi, 320 Japan. N0BNY reports a July operation from VP2K (on his honeymoon!). Pat also QSLs the VP1MK operation at his home address: 2770 South 13th Street, Omaha NE 68108, with SASE. K9MK/5 handles his own QSLs for his /VP2A and /V2A operations at 6061 Dunson Court, Watauga TX 76148. V2AMK should be QSLed to N0DH/7 at 2031 East Gary, Mesa AZ 85203. And finally Nick Percival 9Y5NP of the Trinidad and Tobago Amateur Radio Society announced the 50 Years of Amateur Radio special prefix for his country: 9Y50. Look for Nick and other Trinidad amateurs using this prefix for the rest of 1982.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

WORKED ALL ZONES

The WAZ award will be issued to any licensed amateur station presenting proof of contact with the forty zones of the world. This proof shall consist of proper QSL cards which may be checked by any of the authorized *CQ* checkpoints or sent directly to the WAZ Award Manager, Mr. Leo Haijsman W4KA, 1044 Southeast 43rd St., Cape Coral FL 33904. Many of the major DX clubs in the US and Canada and most national amateur radio societies abroad are authorized *CQ* checkpoints. If in doubt, consult the WAZ Award Manager. Any legal type of emission may be used, providing communication was established after November 15, 1945.

The official *CQ* WAZ Zone Map, and the printed zone list which follows these rules, will be used in determining the zone in which a station is located.

Confirmation must be accompanied by a list of claimed zones, using *CQ* form 1479, showing the call letters of the station contacted within each zone. The list should also clearly show the applicant's name, call letters, and complete mailing address. The applicant should indicate the type of award for which he is applying, such as all-SSB, all-CW, or mixed. In remote locations and in foreign countries, a handwritten list may be submitted and will be accepted for processing, provided the above information is shown.

All contacts must be made with licensed, land-based, amateur stations operating in authorized amateur bands.

All contacts submitted by the applicant must be made from within the same country. It is recommended that each QSL clearly show the station's zone number. When the applicant submits cards for multiple callsigns, evidence should be provided to show that he or she also held those call letters.

Any altered or forged confirmations will result in permanent disqualification of the applicant.

Include with the application the processing fee (subscribers, $4.00; non-subscribers, $10.00) and a self-addressed envelope with sufficient postage stamps or international reply coupons to return the QSL cards by the class of mail service desired and indicated. *CQ* subscribers should include a recent mailing label (or copy) with application. International reply coupons equal in redemption value to the processing fee are acceptable. Checks should be made out to Mr. Leo Haijsman, WAZ Award Manager.

In addition to the conventional certificate for which any and all bands and modes may be used, specially endorsed and numbered certificates are available for phone and single-sideband operation. The phone certificate requires that all contacts be two-way phone; the SSB certificate requies that all contacts be two-way SSB.

If, at the time of the original application, a note is made pertaining to the possibility of a subsequent application for an endorsement or special certificate, only the missing confirmations required for that endorsement need be submitted with the later application, provided a copy of the original authorization signed by the WAZ manager is enclosed.

Decisions of the *CQ* DX Awards Advisory Committee on any matter pertaining to the administration of this award will be final.

All applications should be sent to the WAZ Award Manager, W4KA, after the QSL cards have been checked by an authorized *CQ* checkpoint.

Zone maps, printed rules, and application forms are available from the WAZ Award Manager. Send a self-addressed envelope, 4" × 9½" with 28¢ postage, or a self-addressed envelope and 2 IRCs. For rulings on borderline areas, consult the WAZ Award Manager.

SINGLE-BAND WAZ

Since January 1, 1973, WAZ awards have been issued to licensed amateur stations presenting proof of contact with the 40 zones of the world on one of the five high-frequency bands, 80-10 meters. Contacts for a single-band WAZ award must have been made after 0000 hours GMT, January 1, 1973. Proof of contact shall consist of proper QSL cards checked by the DX Editor, the WAZ Manager, or an authorized *CQ* checkpoint. Single-band certificates will be awarded for both two-way phone, including SSB, and two-way CW. The single-band WAZ program is governed by the same rules and uses the same zone boundaries.

5-BAND WAZ

On January 1, 1979, the *CQ* DX Department, in cooperation with the *CQ* DX Awards Advisory Committee, announced the 5-band WAZ.

Applicants who succeed in presenting proof of contact with the 40 zones of the world on the five high-frequency bands—80, 40, 20, 15, and 10 meters (for a total of 200)—will receive a special certificate in recognition of this achievement.

These rules were in effect as of July 1, 1979, and supercede all other rules. Five-band WAZ will be offered for any combination of CW, SSB, phone, or RTTY contacts, mixed-mode only. Separate awards will not be offered for the different modes. Contacts must have been made after 0000 hours GMT, January 1, 1979. Proof of contact shall consist only of proper QSL cards checked by the WAZ Award Manager, W4KA. The first plateau will be a total of 150 zones on a combination of the five bands. Applicants should use a separate sheet for each frequency band, using *CQ* form 1479.

A regular WAZ or single-band WAZ will not be a prerequisite for a 5-band WAZ certificate. All applications should show the applicant's WAZ number.

After the 150-zone certificate is earned, the final objective is 200 zones for a complete 5-band WAZ. *CQ* is donating plaques for the first 5 winners, after which the applicant will have a choice of paying a fee for his plaque and/or applying for an endorsement commemorating this achievement.

The applications should be sent to the WAZ Award Manager, W4KA. The 5-band award is governed by the same basic rules as for the regular WAZ and uses the same zone boundaries.

THE WPX AWARD

The *CQ* WPX award recognizes the accomplishments of confirmed QSOs with the many prefixes used by amateurs throughout the world. Separate distinctively-marked certificates are available for 2 × SSB, CW, and mixed modes, as well as the VPX award for shortwave listeners and the WPNX award for Novice amateurs.

All applications for WPX certificates (and endorsements) must be submitted on the official application form *CQ* 1051A. This form can be obtained by sending a self-addressed stamped envelope to the WPX Award Manager, Bob Huntington K6XP, 5014 Mindora Dr., Torrance CA 90505. It is highly desirable to use business-size envelopes, 8½" × 11", for this purpose.

All QSOs must be made from the same country. All call letters must be in strict alphabetical order and the entire call must be shown. All entries must be clear and legible.

Certificates are issued for the following modes and numbers of prefixes (crossmode QSOs are not valid for the CW or 2 × SSB certificates): mixed (any mode)—400 prefixes confirmed; CW—300 prefixes confirmed; 2 × SSB—300 prefixes confirmed. Separate applications are required for each mode.

Cards need not be sent but must be in the possession of the applicant. Any and all cards may be requested by the WPX Award Manager or by the *CQ* DX Committee. The application fee for each certificate is $4.00 for subscribers and $10.00 for nonsubscribers, or the equivalent in IRCs. All applications and endorsements should be sent to the WPX Award Manager.

Prefix endorsements are issued for each 50 additional prefixes submitted. Band endorsements are available for working the following numbers of prefixes on the various bands: 1.8 MHz—50; 3.5 MHz—175; 7 MHz—250; 14 MHz—300; 21 MHz—300; and 28 MHz—300. Continental endorsements are given for working the following numbers of prefixes in the respective continents: North America—160; South America—95; Europe—160; Africa—90; Asia—75; and Oceania—60. Endorsement applications must be submitted on *CQ* form 1051A. Use separate applications for each mode and be sure to specify the mode of your endorsement application. For prefix endorsements, list only additional call letters confirmed since the last endorsement application.

A self-addressed envelope and $1.00 or 5 IRCs are required for endorsement stickers.

The two or three letter/numeral combinations which form the first part of any amateur call will be considered the prefix. Any difference in the numbering, lettering, or order of same shall constitute a separate prefix. The following would be considered different: W2, WA2, WB2, WN2, WV2, K2, and KN2. Any prefix will be considered legitimate if its use was licensed or permitted by the governing authority in that country since November 15, 1945.

A suffix would designate portable operation in another country or call area and would count only if it is the normal prefix used in that area. For example, K4IIF/KP4 would count only if it is the normal prefix used in that area. For example, K4IIF/KP4 would count as KP4. However, KP4XX/7 would not count as KP7 since this is not a normal prefix. Suffixes such as /M, /MM, /AM, /A, and /P are not counted as prefixes. An exception to this rule is granted for portable operation within the issued call area. Thus, contacts with a special prefix such as WS2JRA/2 count for WS2; however, WS2JRA/3 would count for W3.

All calls without numbers will be assigned an arbitrary 0 plus the first two letters to constitute a prefix. For example, RAEM counts as RA0, AIR as AI0, UPOL is UP0. All portable suffixes that contain no numerals will be assigned an arbitrary 0.

For example, W4BPD/LX counts as LX0 and WA6QGW/PX counts as PX0.

THE VPX AWARD

The VPX, or verified prefixes award, can be earned by shortwave listeners (SWLs) who possess QSL cards confirming reception of at least 300 different amateur prefixes. No mode endorsements are available. Applications are submitted to the WPX Award Manager in accordance with the WPX rules.

THE WPNX

The WPNX award can be earned by USA Novices who work 100 different prefixes prior to receiving a higher-class license. The application may be submitted after receiving the higher license, providing the actual contacts were made as a Novice. Prefixes worked for the WPNX award may later be used for credit toward the WPX award.

The rules for the WPNX award are the same as for WPX, except that only 100 prefixes must be confirmed and that applications are sent to the WPX Award Manager.

THE CQ DX AWARD

The *CQ* CW DX award and *CQ* SSB DX award are issued to any amateur station submitting proof of contact with 100 or more countries on CW, or SSB. Applications should be submitted on the official *CQ* DX award application.

All QSOs must be 2-way SSB or 2-way CW—crossmode or one-way QSOs are not valid for the *CQ* DX awards. QSLs must be listed in alphabetical order by prefix and all QSOs must be dated after November 15, 1945. Except for the mobile endorsement, all QSOs must be made from the same call area.

QSL cards must be verified by one of the authorized checkpoints for *CQ* DX awards or must be included with the application. If cards are sent directly to the Award Manager, Billy Williams N4UF, 911 Rio St. Johns Dr., Jacksonville FL 32211, postage for their return by first-class mail must be included. If certified or registered mail return is desired, sufficient postage should be included.

Country endorsements for 150, 200, 250, 275, 300, 310, and 320 countries will be issued. To promote multiband usage and special operating skills, special endorsements are available as follows:

- a 28-MHz band endorsement for the 100 or more countries confirmed on the 28-MHz band;
- a 3.5/7-MHz band endorsement for 100 or more countries confirmed using any combination of the 3.5- and 7-MHz bands;
- a 1.8-MHz band endorsement for 50 or more countries confirmed on the 1.8-MHz band;
- a QRPp endorsement for 50 or more countries confirmed using 5 Watts input or less;
- a mobile endorsement for 50 or more countries confirmed while operating mobile. The call area requirement is waived for this endorsement;
- an SSTV endorsement (*CQ* SSB DX award only) for 50 or more countries confirmed using 2-way slow-scan TV;
- an OSCAR endorsement for 50 countries confirmed via amateur satellite.

A fee of $4.00 for subscribers and $10.00 for non-subscribers (or the equivalent in IRCs), to defray the cost of the certificate and handling, is required for each award. An SASE or one IRC is required for each endorsement.

The ARRL DXCC country list constitutes the basis for *CQ* DX award country status. Deleted countries will not be valid for the *CQ* DX award. Once a country has lost its status as a current country, it will automatically be deleted from our records.

All contacts must be with licensed land-based amateur stations working in authorized amateur bands. Contacts with ships and aircraft cannot be counted.

USA-CA AWARD PROGRAM

The United States of America Counties award, sponsored by *CQ*, is issued for confirmed contacts with specified numbers of US counties under rules and conditions hereafter stated.

The USA-CA is issued for seven (7) different classes, each a separate achievement as endorsed on the basic certificate by the use of a special seal for each higher class. Also, special endorsements will be made for all-one-band or -mode operations subject to the rules.

Class USA-500 requires 500 counties, USA-1000 requires 1000 counties and 25 States, USA-1500 requires 1500 counties and 45 states, USA-2000 requires 2000 counties and 50 states, USA-2500 requires 2500 counties and 50 states, USA-3000 requires 3000 counties and 50 states, and the ultimate award, USA-3074-CA, is issued for all 3074 counties in all 50 states. The USA-3074 awardee is given a special honors plaque for a cost of $35.

USA-CA is available to all licensed amateurs everywhere in the world and is issued to them as individuals for all county contacts made, regardless of calls held, operating QTHs, or dates whatever. Special USA-CAs are also available to SWLs on a heard basis.

All contacts must be confirmed by QSL and such QSLs must be in one's possession for identification by certification officials. Any QSL card found to be altered in any way disqualifies the applicant.

For mobile and portable operations, the postmark will identify the county unless information stated on QSL cards makes other positive identification. In the case of cities, parks, or reservations not within counties proper, applicants may claim any one of the adjoining counties for credit (once).

The USA-CA program will be administered by a *CQ* staff member acting as USA-CA custodian, and all applications and related correspondence should be sent directly to him at his QTH. Decisions of the custodian in administering these rules and their interpretation (including future amendments) are final.

The scope of USA-CA makes it mandatory that special record books be used for application. For this purpose, *CQ* has provided a 64-page, 4¼" by 11" record book which contains application and certification forms and which provides record/log space meeting the conditions of any class of award and/or endorsement required.

A completed USA-CA record book constitutes the medium of basic application and becomes the property of *CQ* for record purposes. On subsequent applications for either higher classes or for special endorsements, applicants may use additional record books to list required data or may make up their own alphabetical lists conforming to requirements.

Record books can be obtained directly from *CQ*, 76 N Broadway, Hicksville NY 11801 for $1.25 each. We recommend that two be obtained: one for application use and one for personal file copy.

To apply, make the record book entries necessary for county identity and enter other log data necessary to satisfy any special endorsements (band/mode) requested.

Be sure to have the certification form provided signed by two licensed amateurs (General class or higher) or an official of a national-level radio organization or affiliated club, verifying that QSL cards for all contacts as listed have been seen. The USA-CA custodian reserves the right to request any specific cards to satisfy any doubt whatever. In such cases, applicants should send sufficient postage for return of cards by registered mail.

Send the original completed record book (*not* a copy), certification forms and handling fee. The fee for non-subscribers to *CQ* is $10.00 or 40 IRCs; for subscribers, the fee is $4.00 or 12 IRCs. *CQ* subscribers should include a recent mailing label with their application (or copy). Send to USA-CA Custodian, Ed Hopper W2GT, Box 73, Rochelle Park NJ 07662. For later applications for higher class seals, send the record book or a self-prepared list (per rules) and $1.25 or 6 IRCs (handling charge). For application for later special endorsements (band mode) for which certificates must be returned for endorsement, send certificates and $1.50 or 8 IRCs for handling charges. Note: At the time any USA-CA award certificate is being processed, there are no charges other than the basic fee, regardless of the number of endorsements or seals; likewise, one may skip the lower classes of USA-CA and get higher classes without losing any lower awards credits or paying any fee for them.

SALMON-A-RAMA

The Racine Megacycle Club will be operating W9UDU, a special event station, during SALMON-A-RAMA from July 10th through July 18th, 1982. Operating dates and times: July 10, 11, and 17—1100Z-2300Z; July 18—1100Z-2000Z. Frequency: Fish locators have identified good fishing grounds in the General portion of the phone bands on 10, 15, and 20 meters. Go fishing for W9UDU and receive a special QSL for an SASE to: W9UDU Racine Megacycle Club, c/o American Red Cross—Lakeshore Counties, 4521 Taylor Avenue, Racine WI 53405.

For more information, contact David Voss WB9USI, President, Racine Megacycle Club, 3333 Standish Lane, Racine WI 53405.

WAPAKONETA OH

The Reservoir Amateur Radio Association will operate K8QYL from 1300Z July 17 to 0400Z July 18 and again from 1300Z to 1900Z, July 18, from the birthplace of Neil Armstrong, the first man on the moon. Frequencies: phone—3940, 7260, 14285, 21360, and 28590, plus or minus QRM; CW—50 kHz up from the bottom of the band at the beginning of the odd hours. Check-ins invited on K8QYL/R (147.93/147.33). Certificate for QSL and SASE to: K8QYL, PO Box 268, Celina OH 45822.

TOM SAWYER DAYS

The Hannibal Amateur Radio Club, Inc., will issue a second annual special certificate from the National Tom Sawyer Days celebration in Mark Twain's boyhood home town, Hannibal, Missouri, on July 3-4, 1982. Hours: 1500-2100 UTC both days. Frequencies: phone—7.245, 14.290, 21.400, and 28.700; CW—7.125 and 21.125 MHz. The club will also be observing our 50th anniversary. Help us celebrate! To receive the certificate, send a large (8" × 10") SASE and your personal QSL card confirming the contact to the Hannibal Amateur Radio Club, Inc., W0KEM, 2108 Orchard Avenue, Hannibal MO 63401.

BONFIELD IL

Commemorative amateur radio station K9JLK will be operating from the Bonfield, Illinois centennial celebration from 1300Z, July 4, 1982, through July 5. Operating frequencies will be 223.50, 144.250 (SSB), 146.520 (FM), 50.115, 28.600, 21.400, 14.325, 7.275, and 3.8-3.9. For QSL, send an SASE to Jerry Whalen WB9WOC, RR 2, Kankakee IL 60901.

WINONA MN

The Winona (MN) ARC will operate WB0NIU on July 3 to commemorate the 125th anniversary of the signing of the charter of the city of Winona. Winona is a river town in SE MN. The station will operate from 1500Z to 2100Z on 7.245, 14.290, 21.365, and 28.650 MHz. A special QSL for working this station will be available by SASE to Erik W. Brom WB0NIU, 3655 6th St., Winona, MN 55987. Other area stations will also be using these cards.

CELINA OH

The Reservoir Amateur Radio Association will operate W8DN from 1300Z to 1800Z, July 24, from the courthouse lawn during the Celina Lake Festival. Frequencies: phone—3940, 7260, 14285, 21360, 28590, plus or minus QRM. Check-ins are invited on WB8FNB/R on 146.01/146.61. Certificate for QSL and SASE to W8DN, PO Box 268, Celina OH 45822.

LETTERS

KB7NW A WINNER

I would like you to know that the article "Pacific Odyssey" by KB7NW was one of the best I have read in a long time. I thought the way it was organized and presented was top-notch, as was the use of photographs to supplement the excellent story line. I could almost feel I was there!

If you give awards for well-presented articles, J.D. Binders' "Pacific Odyssey" to Kingman and Palmyra sure get my vote!

This article is a credit to your magazine.

Homer Lasitter W6QX
La Jolla CA

We're glad you liked "Pacific Odyssey," Homer. And thanks for writing. Not only will the author enjoy your comments, the 73 staff appreciates the feedback. We encourage readers to let us know when they particularly like (or dislike) something in 73.—N8RK.

NO NUKES—I

I am a firm believer in our First Amendment rights, but I take issue with the basic premise of the May, 73, article, "Surviving the Unthinkable." Yes, I agree that hams have a responsibility to be prepared for emergencies, but nuclear war IS unthinkable. There would be NO survivors. Preparing for a nuclear holocaust assumes there must be one, and that attitude just might help it happen. Hams should not give in—we must fight for our right to a life of peace.

David Stoft WD6DXX
Spokane WA

NO NUKES—II

I am upset by the "Surviving the Unthinkable" article in your May, 1982, issue, for several reasons. A sense of practicality plus the firm grasp on Murphy's Law which most amateurs have should reveal the weaknesses of the FEMA claims for how we shall evacuate. Missiles take only 30 minutes to arrive, and it will take far longer for all those in target areas to depart. To hope for any better circumstances is to hope that one's new antenna installation is going to go in without a hitch. Wishful thinking will not hack it.

True, amateurs can help in almost any emergency, but I feel that all amateurs should be burning the airwaves *now* to try to talk to anyone anywhere on the planet to forward the goal of preventing "the unthinkable." To cheerfully accept ten million deaths is insanity, no matter what the format!

I sense that this is another "Gee, gosh, we can be so helpful" article. I do not want to be in the position of trying to provide emergency service to what would be left. I would rather work now at some other solution to the problem than get first-hand experience on how Murphy would operate with nuclear weapons as tools of his "whatever can go wrong, will" policy.

Amateurs have a unique ability to speak to peoples of other countries. Let's use that ability to forward efforts to prevent a nuclear conflict, rather than become another vulture watching over a possibly dying America as a part of this government's new Civil Defense push.

David Gibbons
Carmichael CA

BASH REHASH

Concerning the ongoing Dick Bash story, I'd like to add another log to the fire.

When's the last time you sat back in your favorite chair with a copy of *QST*'s Q & A manual? Unless you're sitting on a bed of nails with five kids screaming around you and the TV set too loud, within a few minutes after opening the front cover, you'll be checking the insides of your eyelids for holes. In short, it's more boring than a monotonous voice telling you last week's news.

The questions in that venerable manual are not quite the same as found on the FCC tests, but then again, if you look closely, they're not all that much different, either. The tricky part is trying to wade through what is termed an answer without having to reread it many times. By then, your attention and patience are wearing thin. After a few pages of this you begin to wonder if it's worth it. Those of stout heart and strong desire may make it just a bit further, but eventually the book is closed and gathers dust. The *Ameco Study Guide* is not quite as bad as it lays out the explanation without so much fairy dust sprinkled on it. If you haven't had the time to look over one of Dick Bash's books, he does give the test question and the test answer, but it doesn't just stop there. It explains why that is the correct answer and does it with enough literary flair to keep your interest to the point of making a more lasting impression.

For several years in the Army, I taught basic electricity and aircraft electrical systems to servicemen who not only didn't want to be there, but some of them shouldn't have even been there to begin with. Vietnam caused some barrel scraping near the end. How do you teach people like that? You create an atmosphere or situation that captures their interest. It wasn't easy and most instructors didn't even try, but when you succeeded you knew it and the students knew it, too. I was also partly responsible for writing tests and lesson plans. My approach was somewhat similar to Dick's although greatly restricted due to bureaucratic regimentation.

Have you ever met Dick Bash? He's outgoing and congenial but a bit of a maverick, like most people who create or lead. He saw a weakness in the self-tutorial method of teaching a complex subject that was sorely lacking in instructional material that filtered out the black boxes, witches, and demons. There are those in this world who consider electronics as "black magic" and some of them are hams. Basic electricity, if taught properly, can be interesting and informative. If college courses are offered for electronics, how does the average person expect to learn it without some help?

Letters to editors are strange things. This is my first and probably last one. Every subscriber gets to read the editorial—which is really only one man's opinion—and the mass is left to draw its own conclusions but based only on the editorialized facts. The editor may consider it his prerogative to tell it the way he sees it, and who's to dispute it? I feel you were wrong to so vehemently condemn Dick Bash as you did and not give everyone the facts of what the book is really like. I've met Bash class graduates and find them no different from hams I met 10 or 15 years ago. We need to increase and strengthen our numbers and I don't feel one bit like we're compromising ourselves with Dick's books.

I can almost understand *QST* not wanting to run his ads. After all, a "non profit" organization in the publishing business with a corner on most of the "instructional material" has to protect its own interests. Doesn't it? What all this boils down to is this: Whether you consider the Dick Bash books unethical or not, they get the job done of informing and teaching. Even my wife learned enough to evoke a response of, "So that's how it works!" I'm not going to fault Dick's system one bit because it works. What I do fault is your remarks of "poison" and "being insidious" without ever telling what the books are like and letting people draw their own conclusions. I would expect that of a rag like the *National Enquirer*, but not from *73 Magazine.*

Fred Palmer WA5WZD
Corinth TX

Have I met Bash? Heck, Dick worked for us here for a while. He drove us crazy and we gave up trying to harness him. We parted good friends and I think stay that way. Dick knows what I think of his "system" and why.

The Bash approach does give some slight attention to explanations, but the brunt of his books is to present, word for word, the questions you are going to face... and their answers. The one-day intensives are designed to fill your short-term memory with the questions and answers, not long-term real understanding of electronics and radio. If you are unable to take the FCC test the next day after an intensive by Bash, you can be in deep trouble.

One of the more serious disasters of our whole educational process has to do with the continued use of short-term memory for the passing of tests instead of getting the information into the long-term memory. This is why so many students have little recollection of a course once they have passed it. This was my major gripe with college, where the emphasis was on read-and-take-a-quiz, with little effort to discuss the material and thus give it a chance to be understood and filed away in more permanent memory.

The Navy, on the other hand, had a fantastic course in electronics, where they taught theory and then immediately took you into a lab to work with that theory and thus grow to really understand it. In classes, we discussed the theory until we were able to think in electronic terms. If I'm able to get a college started, it is going to teach the students to think, not memorize. They are going to learn about electronics and then work with it. They will learn about communications and then learn to design, build, and service equipment. They will learn computer design... and repairs. They will learn to write programs and fix 'em.

It may be that amateur radio has so fallen apart under the pressures to let in one more friend or wife that it no longer is even considered important for hams to understand radio. If so, we should formally agree with this and throw away our charter, section 97, and put amateur radio and CB together into one service, being honest about our motives.

Fred, when I suggest that hams get mad about this and rush to their neighborhood ham store and rip Bash's cheat books to shreds, I know... as do you, if you think about it instead of reacting... that what will happen is a rush to buy these short cuts to getting a ticket. They do work. It is now possible to get a ham ticket without really knowing a damned thing about electronics or radio. People with a knack for the code can learn it enough to pass the test in about one hour. That's how long it took me to get to 5-wpm solid copy right from not knowing a single character.

If it's easy ham tickets you want, Fred, you've got 'em now. But I don't see that bringing in many hams. Hell, we can't even give ham tickets away these days. Now, I may be wrong about wanting hams to clean up the act... to get our clubs to start teaching the fundamentals of theory and making sure that newcomers qualify. Most of my mail says I have a lot of hams backing me, but there are opponents such as you.

Perhaps we are still being too strict in our tests. One could certainly make a case for the amateur tests being biased so that they exclude blacks, women, Chinese, Latin-Americans, and other such groups. Perhaps it is time for a move toward affirmative action and an open-door policy for these under-represented groups. Should we start seeing how simple we can make the procedure in order to give these minorities (and the female majority) their "rights"?—Wayne.

NO MISTEAK HERE

This letter is in reference to FCC spokesman Vernon Wilson's denial of misspellings on FCC code tapes (page 121, *73*, May, 1982).

Over the last few years I have taken one General class test and two Extra class tests (one failed because of nerves and pressures and one passed with 100% a month later). I found these tests to be difficult. However, there were no misspelled words, irregularities, or even sneaky tricks. I even had Springfield on one (spelled correctly). Interestingly, one fellow told me after the test that he had copied Springvale; another had copied Springdale.

Under the extreme pressure we hams generate within ourselves at test time, I believe it is quite possible to sincerely, but incorrectly, copy "mistakes" that simply are not there.

Lincoln Thorner KS2H
New York NY

KS2H's letter is like several others we have received. No one has come forward with documented evidence of a misspelling on the FCC code exams.—N8RK.

BRAINS NOT FISTS

I have here in front of me the March issue of *73 Magazine*, but what I want to talk about is not how much I like it but your stand concerning the requirement for the Morse-code test.

There should be no question but that in this day and age of space exploration and digital electronics, this requirement is pathetically antiquated and comparable to requiring Greyhound drivers to know how to handle a Conestoga wagon. It serves no purpose other than to keep away from amateur radio technically competent people who have neither the patience nor the time to waste in learning a skill that has no place in state-of-the-art electronics.

All of the surveys that showed "overwhelming opposition" to a no-code license have been performed with no objectivity and a lot of bias in a group of individuals who had a vested interest in the outcome. Nobody should be a part of, or a judge in, a contest of any kind who thinks: "What? A no-code license? Over my dead body! Let them sweat it out as I did!" You don't have to be endowed with divinatory powers to know beforehand the outcome of such a survey. In other words, newcomers not welcome!

Keep up the good work and be sure that once again we will see in the future who was right. What we need today is brain, not fist! Your suggestion to use technical knowledge as a filter, instead of Morse-code skill, does make a lot of sense.

Oh, by the way, let me tell you that I am not a frustrated would-be ham who flunked the code test. Many years ago, more than I care to remember, I had to get a commercial second-class radio operator's license (including Morse at 20 wpm), and to this day I fail to see what good can come to amateur radio by turning the code skill into a fetish.

It is about time that some common sense is written into these regulations.

Paulo G. Lefevre
PY1AQL/CT1EM
Carcavelos, Portugal

Olé.—Wayne.

HORSERADISH DISPLAY

I've been fascinated by QSL cards since I was an SWL in the early 1950s. A QSL is a special thing—representative of the individual, locale, and country of origin. I am quite aware of the expense involved, be it the simplest "Quick Print Shop" shot of a hand drawing or the elaborate five-run or color photographic rendition.

The thing that moved me to write this letter is the volume of cards seen since become a DX QSL manager (CE5BYY). Gentlemen—the ladies are now left out, they do it right—the blotter paper and repetitiously inane renderings passing this way don't even rate a shoe box as a repository. As a person driving up in an unwashed, beat-up automobile makes a lasting first impression, so do your cards.

It pains me to see that cards from the South Pacific that ten short years ago had swallowtail butterflies, birds of paradise, and outrigger canoes now look like the cards of members of the Southern California DX Club. How many cards can a person with DXCC, WAZ, and God-knows-what-all possibly send? Economy seems to rule, however, and I would offer the following comments.

1. Lack of return postage is a paramount issue as it makes the card expense critical.

2. The card's free, the freight ain't.

3. If you care and really have had at least one original thought in your life, consider the fact your card represents *you*, so do it cute, professionally, or at least in good taste and design.

If you're tired of seeing your country QSL display looking like horseradish and mustard, the solution really rests with you and the merchants of mediocrity who simplify the continuation of the problem. The DX is really waiting for you to get your act together.

Terry F. Staudt W0WUZ
Evergreen CO

Readers who don't like horseradish are encouraged to submit a QSL card to 73's monthly contest. You will find details with this month's winner.—N8RK.

DX FOR THE BLIND

Two years after losing my sight from detached retinas, I obtained my Novice class license. Six months later, I achieved General class status and have been a DXer ever since. Two common problems for the blind DXer are the inability to obtain current DX information and the difficulty of filling out DX cards.

I am writing this letter to inform blind DXers of a new and exciting service. The Braille DX Service provides: (1) a monthly cassette recording of current DX activity and expeditions, as well as important QSL information, and featuring the Kansas DX Association monthly newsletter, (2) a current DXCC countries list in Braille or on cassette tape, including regular up-to-date prefix changes, and (3) a personal QSL manager for outgoing cards. Volunteers fill out the blind DXer's QSL cards, and log information is passed, either by on-the-air schedules or simply by mailing the information direct to the volunteer. Log information can be recorded on cassette tape and mailed to the volunteer.

Membership is simply a one-time $2.00 donation to help purchase blank cassette tapes for the monthly newsletter. The Kansas DX Association has demonstrated their interest in this program by providing a cassette recording of the monthly newsletter and volunteer QSL managers for the blind DXer.

Phil Scovell AF0H
Lakewood CO

3 CHEERS FOR MFJ

I want you to know about an experience I had with one of your advertisers. Two years ago at the Atlanta Hamfest I purchased an MFJ-962 antenna tuner. Well, as you might know, I probably loaded it wrong and blew a small coil in the swr bridge circuit. I called them on their WATS line, and it was not until later that I read down the page a bit and saw that I had called the sales number and not the parts and service department. A very pleasant YL answered and, not understanding what I wanted to order, she connected me to an OM by the name of Stan. I explained to Stan that I had blown the coil, that the unit was out of warranty, and that I wanted to order another. Well, a strange thing happened for these times, as Stan refused to sell me the coil; instead, he insisted that I give him my name and address and he would get one out to me in the mail . . . at *no charge*! Now that is what I call darn good business PR.

It was not so much the cost (or in this case, non-cost) as it was the pleasant manner in which this was handled, and I would appreciate it if you would let your readers know about one of the "good guys"—MFJ Enterprises of Mississippi State, Mississippi.

Don Williams Sr., Publisher
68 Micro Journal
Hixson TN

HAM PEACE CORPS

In your *73* issue of November, 1981, I saw your editorial about South Africa and would like to record my disapproval of your visit to the Republic of South Africa.

South Africa is the only remaining country which violates human rights on the basis of race (skin pigmentation). This violation is perpetual and cannot be transcended (because you cannot change your color) and is grossly unfair to its people and the people of the world (because such ideas might spread out of South Africa to the rest of the world again). Therefore, it is necessary to fight such an unfair system by all means, including withholding technology, sports contacts, amateur radio contacts, etc.

Why? Because the racist minority in power (which does *not* include all South African whites) can use such technology to oppress the majority and international sports and cultural contacts to win international acceptance and legitimacy. Building up communication technology through amateur radio is one such example—communication technology can be used to spread ideas of apartheid and for police and military purposes.

You might say, sure, South Africa violates human rights, but what about other dictatorial regimes in Africa/South America/Asia? There, oppression is through ideology (belief systems) or money (class background of a person), etc., and boycott action against them is valid and is practiced, e.g., against Chile, Poland, etc. The only similar case is the caste system, as it is practiced in the feudal and backward areas of India—where you are born into a caste and are discriminated against.

As a citizen of a multi-racial democracy (the same as in your case) where people of various races (Caucasian, Mongolian, and Negroid) live in harmony, settle, and marry across regions and are guaranteed the same constitutional rights, I think it is our duty to discourage contacts with South Africa.

Right now, the Republic of South Africa is involved in a PR campaign (albeit the organization of such a campaign may well be loose) and is trying to get scientists, scholars, and sportsmen to visit them (e.g., UK cricket players, Taiwanese scholars, etc.). Clever as they are, they sent Dr. Christian Barnard (the famous heart surgeon and a believer in racism) to India, knowing that he would be the least objectionable here.

I respect *73* for its boldness (in criticism of regulatory bodies), its presentation (which is lucid and interesting), and its keeping abreast of new technology, and this is the very first time I feel the urge to express my disapproval. I hope that you will take it in a constructive spirit and respond to my arguments.

Gopal Kamat VU2JE
Bombay, India

Well, Kamat, just in case there are some readers who agree with your thinking, it might be prudent to answer your criticisms. Let's go back a few years to the time when the US was involved with Vietnam. Recall with me, if you will, that my country was being severely criticized by much of the world. Many people were busy not visiting the US be-

cause it was involved in that unpopular war.

Possibly, Kamat, you were not a reader of 73 during those years. If you had been you would know that there were a number of Americans who were not in favor of the war. Some reacted by being completely negative about it...just get out and leave 'em alone. Others recognized the problems involved, but felt that there was more than one way to respond. Indeed, I made a trip around the world and talked with hams in many countries about the situation. As a result, I developed a plan which I felt was far better than fighting. I distilled the ideas I ran into in Yugoslavia, Thailand, Singapore, and New Caledonia as I talked with hams in these countries.

My plan seemed relatively simple, workable, and most likely to result in avoiding further bloodshed. I am convinced that if the US had followed it that a unified Vietnam would be free of communism...as would Laos and Cambodia. I wrote of my plan in 73 and got hundreds of letters supporting it. I also sent it to Congress, but as far as I know not one copy ever got through the assistants. I failed ...but at least I tried.

Now, about South Africa. Sure, many people are at odds with the South African government. But does that mean that we have to hate South Africans? What possible benefit is that to anyone? I went to South Africa to visit the hams and computer fanatics, not the government. As a matter of fact, I don't think I met anyone from the government.

The people that I did meet and talk with are as helpless about the policies of their government as I was about mine. They, sadly, have far less freedom to speak up in criticism...but then there are very few countries which are as permissive as the US. And remember, please, that there are some government agencies in the US which will not permit open criticism. Our country is good in many ways, but it is far from free as yet.

May I contrast your negative attitude with my positive one. You advocate not visiting countries of which you disapprove. I advocate visiting them and advocating changes to them which will improve the situation. Indeed, while I was in South Africa I went on television during prime time and said flat out that it was time for them to consider making some moves to change their basic policies. I am told that over a million blacks and whites saw my broadcast.

I think I got their attention when I put it this way...I explained that there are about 59 countries in Africa and that approximately 58 of these hate South Africa. I suggested that perhaps it was time to start doing something to counter this ...and I had a positive suggestion, not a negative one.

As I pointed out, we are entering an electronic age. Computers and telecommunications are inseparable with the future. I also pointed out that unless South Africa did something... and quickly...the country would be passed by in technology. To keep up with the need for people to invent, build, operate, and service the technology of the future, they are in need of tens of thousands of technicians and engineers.

The only reasonable source of this many technical people will be for South Africa to make it a policy to introduce amateur radio and computer clubs in their high schools. They will have to get teenagers interested in technical careers.

Okay. The next step is an obvious one...the need for technical colleges to bring these interested teenagers up to the state-of-the-art in electronics, communications, and computers. This can be done either the expensive way...by the government paying for it...or it can be done by getting private industry to pick up most of the tab. I suggested they consider my plan for opening a college which is integrated with several local electronics businesses. In this way, the students would get the best of the formal technical education...and the practical professional experience of working with a business firm.

Further, I proposed that they include plenty of business courses so that the students would be well rounded in both technical matters and business. I suggested that they teach advertising, writing, speaking, finance, hiring, personnel management, purchasing, and so on.

The income from working with the on-campus firms would keep the end cost of the education low and within the reach of most middle-income families.

Then, once this idea had sunk in, I proposed what my interviewer called the Electronic Peace Corps. This was a plan to bring in worthy students from the other African counties for a free education in this new type of school. The cost would be low and the students, once they returned to their native countries, would soon rise to the top by virtue of their education and experience.

The people in the other African countries realize that they have no opportunity for a good education unless they leave their country. At present, the only sources for a free education lie in Moscow and Havana. These are not very attractive alternatives. Further, the people in these countries realize that they are on a downward spiral, something which only an infusion of educated people can change.

The courses in South Africa would not, at first, be very popular because of the hatred. But something as valuable as that for nothing might overcome all sorts of emotional blocks. South Africa would have to see that the black students were treated fairly and given the best of educations. I think the floodgates would open and eager students would come in from all over Africa.

It will take a long time to change Africa...but isn't it time to get started? There are tremendous resources in Africa ...with plenty of country for farms, millions of educable people, and nowhere to go but up. Yes, there are tremendous obstacles. I've been there and seen them. I've talked about them with ham friends in many of the African countries. We're looking at several generations before things are really changed.

But with educated entrepreneurs in more and more African countries it could be possible to stop the destruction of these countries by their despot leaders and to start working for their eventual strength.

Isn't it better to visit a country and make a try at doing something to help change things? The thousands of people who have not visited South Africa have done nothing. It may be that my voice has been completely lost...but I did try.— Wayne.

REVIEW

ICOM IC-4A 440-MHZ HT

I recently purchased an Icom IC-4A 440-MHz hand-held FM transceiver because I wanted to get on the FM portion of the 3/4-meter band in the most cost-effective manner possible. I wanted to move up from the Motorola T-44, which lacks frequency stability and is quite large and heavy. I believe that I made a very good decision and if you'll read on, I'll be glad to tell you why.

First, I decided that my next rig would be new. With a unit straight from the factory, you get some kind of a warranty—at least saying that it will work right from the start. (Everything that I ever bought used always had something wrong with it.) Usually one faces a minor thing such as a noisy volume control or a worn-out switch. But if it is an intermittent problem that wants to be hard to trace down, may God help you! Also, when people sell their old gear they seem to want almost what they paid for it way back when. This is good salesmanship, I suppose, but I'd rather spend the extra bucks for state-of-the-art and a warranty.

No Crystals

Second, I decided that the rig would be synthesized. Activity on 440 is growing as more and more of the two-meter-FM crowd are getting one of the current crop of 70-cm FM hand-held units (Icom IC-4A, Yaesu FT-708R, Tempo S-4, Santec ST-440/up). Therefore, more repeaters are bound to appear.

Transmit and receive crystals of the high-accuracy (HA) vari-

Photo A. The IC–4A hand-held 440-MHz FM transceiver. (Photo by Michael D. Landis)

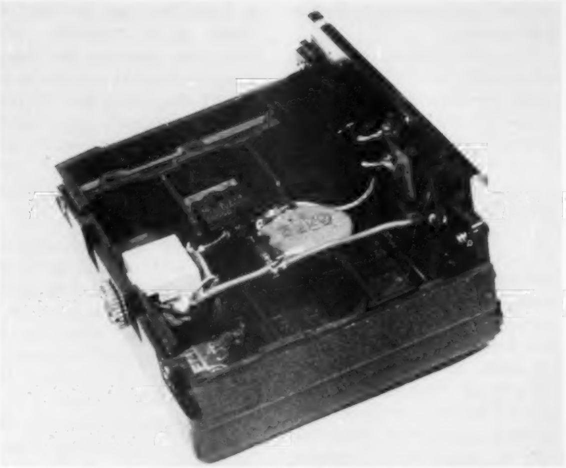


Photo B. The regulator circuit in the BP-4 case. (Photo by Michael D. Landis)

ety go for just over thirteen dollars a copy (anything less just doesn't make it). After a one- to two-week wait, the crystals arrive, and after installing them in the radio, you get to adjust those tiny trimmer capacitors until you are exactly on frequency. Also, the price of twenty crystals, as an example (ten for transmit and ten for receive), times thirteen dollars each comes to $260, which is about what I paid for my IC-4A.

The IC-4A offers 2000 possible channels—the top 10 MHz of the 420-to-450-MHz band, in 5-kHz steps. The thumbwheel switches select the frequency in 1-MHz, 100-kHz, and 10-kHz steps, with the 5-kHz select switch just to the right of the thumbwheel switches. (The switch at the extreme right is not used by Icom—it is there for you to wire up a switchable tone encoder.)

The antenna connector is a BNC type, and below it are external microphone and speaker jacks. To the right of the antenna connector is an LED which lights during transmit. It also serves as a battery indicator; if it goes out while you are squeezing the push-to-talk switch on the left side of the radio, your battery has just died. (You can, as soon as you notice the LED go out, immediately unkey, then key up again and say rapidly, "This is [your callsign]—clear," if this makes you feel better. You may even get through. If not, the next person in line will probably sign you out.)

On the back of the radio are three slide switches. The rf power switch, which is the top one, selects between .15 Watts out in the low position and 1.5 Watts out in the high position. In the low-power position, you draw only 43% of the current that you do in the high position, so you can transmit about twice as long. But remember that you're putting out only one-tenth the power. I do not consider this to be a good enough trade to warrant the use of the low-power position unless I am within spitting range of a repeater.

Below the power-select switch is a duplex/simplex select switch, and below that is a +5-MHz/–5-MHz transmit offset switch. Don't ask me why Icom does not use a single three-position switch that has 5 down, simplex, and 5 up on it. My IC-4A does not have an out-of-band transmit-inhibit circuit in it since the HT will transmit from 435.000 MHz to 454.995 MHz when in the duplex mode.

The microphone is located on the front of the radio case to the bottom right of the speaker, just above the word "microphone" that is molded onto the case. I was so used to those CB-type hand-helds where the speaker is used as the microphone that it took me a while to realize that I was directing my voice into the wrong place. Talk into the lower-right corner of the speaker where there is a little rectangular slot cut into the case, and you will get full audio quality!

The unit comes in a grey plastic case, lacks the bells and whistles that inhabit the fronts of other brands of HTs, and doesn't have as much shiny metal. To me, it looks more like a policeman's HT than a ham's playtoy.

Along with the radio you get the rubberized flexible antenna, a BP-3 battery pack and a wall charger for it, a metal belt clip and two screws with which to attach it to the radio, a hand strap (which I never use), an earphone (which I never use), and one each submini plug and mini plug for the external mike and speaker jacks. You also get an instruction manual which gives a good general idea of what is going on, and two separate sheets which are quite detailed schematic and circuit board layouts. The size and appearance of the rig is identical to the IC-2A/AT, and except for antennas, they use the same accessories.

The radio will not scan unless you want to wear out your fingers on the thumbwheel switches, so you must own a programmable scanner or know the frequencies you will be using. Otherwise, you may need to get one

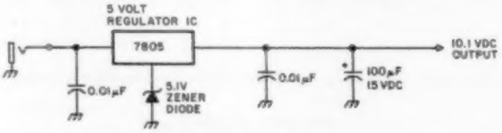


Fig. 1. Regulator built into a BP-4 battery case.

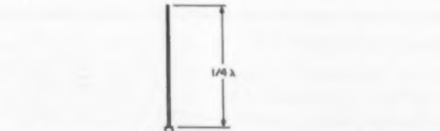


Fig. 2. An improvised quarter-wave ground-plane antenna.

of the band-scanning rigs instead of this one.

For some serious rag-chewing with this rig, you need either a basketful of batteries or an ac-operated power supply. I have built a regulator circuit into a BP-4 battery pack case which allows me to use the car battery (via a cigarette lighter power adapter and a miniature plug) or my unregulated 13.8-V-dc power supply at home. The schematic for the regulator is shown in Fig. 1, and Photo B is a close-up of the finished product. (If you don't like my way, you can look up WB3JJF's article in the February, 1981, issue of *Ham Radio.*)

When I'm at home, I use an improvised quarter-wave ground-plane antenna that works quite a bit better than the rubberized whip antenna. It consists of a pizza pan (for the ground plane) with a hole in the center to hold an SO-239 jack. (See Fig. 2.) I soldered a stiff copper wire to the top of the jack. A PL-259 plug with RG-58/U or RG-8/U cable is screwed onto the connector, and the length of the copper wire whip is trimmed to one-quarter wavelength or for lowest standing-wave ratio at your favorite frequency.

Unfortunately, I don't have a lot of sophisticated test gear, but I can tell you that .3 microvolts of signal will definitely quiet all the rushing noise in my receiver. The power with a fresh battery is somewhat higher than that stated in the manual, and most amazing of all (to me) is that all channels are stable, with very little frequency drift.

I got my IC-4A for just under $260 from my local ham radio store in December, 1981, and for another twenty dollars or so, I could have gotten the touchtone™ pad version.

I want to thank WA8JJI for the improved antenna idea, my sister Frances for the permanent loan of two of her pizza pans, and also Mike Landis, who took the pictures.

Now I can hardly wait for Icom to come out with its 23-cm (1215-1300-MHz) band HT. For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Walter R. Stringer N8BSG
Ferndale MI

IC-25A 2M FM MOBILE RIG

It may be a mystery to most of us how the manufacturer managed to stuff so many components, operating features, and good ideas into so small a package, but it is no mystery that the trend in ham gear today is toward the small. In this ham's opinion, with reference to medium power (25-W) VHF ham gear, the apogee of miniature electronics is reached by the Icom IC-25A two-meter FM mobile rig.

Features

The rig measures a mere 5″ by 2″ by 7″ and weighs in at a paltry 3.3 pounds. Within these lilliputian dimensions, Icom has crammed 48 transistors, 5 FETs, 19 ICs, 91 diodes, and a 4-bit microprocessor to keep track of the lot. The result of this shoehorning is a feature-packed mobile radio that offers the user: 25-W/1-W power outputs, scanning of five memory and two vfo frequencies, full or programmed band scan, programmable splits for non-standard repeaters, dual-speed vfo tuning in 5-kHz or 15-kHz steps, seven-segment S/rf LED bar display, priority channel function, normal/reverse function for monitoring repeater inputs or working inverse splits, and, most important, two fully-independent vfo's. And all this from the front panel!

Should you require more options, you need only open the top cover to gain access to: a scan speed control, a scan-stop timing control, a scan-stop timer switch, and a scan-stop function switch. The last allows the operator to choose either busy or open channels for scan-stop.

By comparison, the rear panel is simple. Here, arrayed around a massive heat sink of the SC1019 power amplifier, is a power-connection cable, an SO-239 antenna connector, and an external speaker jack (4 to 8 Ohms).

The IC-25A is designed to run off a 13.8-V-dc source, and no provisions are made for reversing the negative ground configuration of the supply. The manufacturer claims that the unit draws 400 mA in squelched receive and 600 mA with full audio output of 2 Watts. In the transmit mode, the rig draws 1.3 A at one Watt out and a healthy 4.8 A for the full 25-W output. Icom suggests that a 6-A supply be used in base-station applications.

Design

Electrically, the IC-25A exemplifies solid design practice. The transmitter uses a double-balanced mixer and variance-reactance frequency modulation to generate 16F3 output. A high-impedance dynamic mike with built-in touchtone™ pad and preamplifier is provided as standard equipment. The receiver employs a double-conversion superhet scheme (i-fs at 16.9 MHz and 455 kHz) as well as a MOSFET rf amplifier. A double-balanced mixer, two monolithic crystal filters, and several ceramic filters are provided to improve selectivity.

The most unusual aspect of the IC-25A's design is the dual vfo system. The rig's heredity can be seen clearly from its frequency-control system, and anyone who has ever operated an Icom 701, 720, 730, etc., will feel quite at home with the IC-25A. At the heart of the frequency-control system is a digital phase-locked loop (PLL) circuit that generates 40-MHz and 122-MHz signals.

A rotary encoder connected directly to the main tuning dial generates clock pulses for up/down frequency selection. A 4-bit-wide CPU chip running under the control of Icom firmware provides the smarts. The result in an extremely flexible frequency-control system that allows for continuous tuning in 5-kHz or 15-kHz steps, depending on which of the two vfo's is chosen.

About the only feature left out of the IC-25A's frequency selection system is the ability to memorize offsets. As a result, operator intervention is required if operation is desired on a memory frequency with a new split.

Performance

The bottom line for any piece of mobile gear is its performance on the open road. After commuting with the IC-25A for more than three months, I can say honestly that it is one of the friendliest mobile rigs I have ever used. Of paramount importance in a rig this size is front-panel layout. With 13 controls jammed into an 11-square-inch area, the ergonomics of the layout had better be good.

Vfo and memory-selection channel switches are located toward the driver, on the left side of the front panel. The large main tuning knob also is skewed to the left. Volume/on-off and squelch/high-low power controls are placed adjacent to one another and, immediately above them, three push switches provide easy (yet isolated) access to scan-width control, simplex/duplex control, and Nor/Rev function.

The one inconvenient placement on the front panel is the proximity of the memory-write switch and the scan-stop switch. A problem often occurs when, in an effort to initiate scanning, an operator inadvertently depresses the memory-write switch. When this happens, an erroneous frequency (whatever happens to be in the vfo at the time) will be written into one of the memory channels. The problem is further compounded by the identical feel of the switches. (Mike-scan control is an option, however.)

Another front-panel shortcoming involves the display. Aside from the normal visibility problems inherent with red displays operating in bright sunlight, the IC-25A display is difficult to read because it uses an LED instead of a full 7-segment digit in the 5-kHz position. As a result, it can be difficult to discern whether the frequency is 7.37 or 7.375. There seems to be room on the front panel for a full-size 4-digit display, and the rig certainly would benefit from the addition of a real digit in the 5-kHz position.

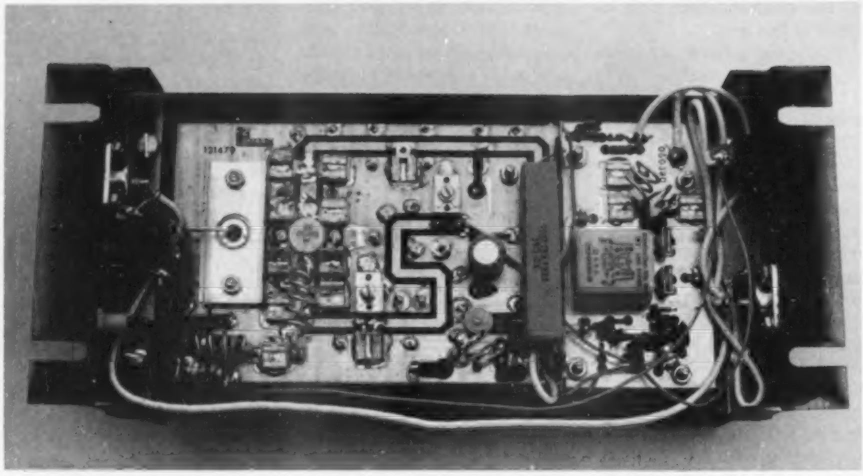
Used in conjunction with a 1/4-wave whip, the IC-25A was able to access any repeater it heard. In fact, it often heard too much. My unit displayed adjacent-channel interference on strong signals (40-60 dB) 15 kHz away from the center of the passband, resulting in cross-modulation of the incoming audio. The problem seemed more acute on the high side of the passband, indicating a slight receiver alignment irregularity. In any case, the problem, though annoying, was apparent only on the strongest of signals.

With any radio of this complexity and compactness, documentation is crucial. Icom has done a laudable job in this area, and its efforts are by no means limited to the 34-page owner's manual. An 11″ by 16″ schematic is included as well as life-size component overlays for each PC board. When used in conjunction with the comprehensive theory-of-operation section of the manual, graphics like these could get hams once more into troubleshooting and even repairing their own gear.

The IC-25A is an impressive package of performance and features at a very competitive price. (The list price is $349.) Its small size will make it attractive to owners of today's gas-efficient micro-cars, and as an added benefit, when installed in-dash like a normal car radio, the rig is relatively immune to theft. If you want big radio functions in a small package, Icom's new IC-25A is worth your consideration.

For more information, contact *Icom America, 2112 116th Ave. NE, Bellevue WA 98004.*

Chris Brown KA1D
Groton MA



Heath VL-1180 All-Mode VHF Amplifier. The amplifier board is on the left, T-R board on the right.

HEATHKIT MODEL VL-1180 ALL-MODE VHF AMPLIFIER

New England is a land of hills and valleys; it's challenging country for 2-meter mobile operation. I discovered just how challenging shortly after installing a 10-Watt rig in my car. Delighted at being able to hear my buddies chatting on a popular repeater some 20 miles distant, I attempted to join the conversation. "Sorry old man, you're not quite making the machine." How humiliating!

An amplifier was definitely in order. And since my 2-meter rig is an all-mode radio, I wanted an amp suitable for SSB and CW, as well as FM. The Heathkit VL-1180 All-Mode VHF Amplifier had just been announced. As a long-time Heathkit builder, I couldn't resist.

Description

The VL-1180 is a linear amplifier covering the 144-148-MHz range. It is designed for use with exciters providing between 1 and 10 Watts of drive. A Motorola MRF-247 transistor is used as the final, and the nominal output is 75 Watts with 10 Watts input. Insertion loss is 0.6 dB. The amplifier features a self-contained transmit-receive (T-R) relay which is keyed either by a push-to-talk line from the exciter or by the rf sensing circuit built into the VL-1180. The amplifier operates on 11.5-15 V dc and draws 11 Amps at 75 Watts output. Standby current is a mere 3 mA.

The VL-1180 measures 2-1/2 × 4-5/8 × 10-1/2 inches and weighs 3-1/2 pounds. A power switch is the only control provided. The power leads and T-R switching line (if used) enter the amplifier by way of a three-conductor Molex® plug.

Except for connectors and the power switch, all components in the VL-1180 mount on a pair of double-sided printed circuit boards. The larger of the two holds the amplifier circuitry. A smaller board contains T-R switching. Assembling the amplifier took five easy evenings. While no insurmountable problems were encountered, the amplifier board was a challenge in one respect.

In order to ensure a good connection between the ground foils on the top and bottom of the board, you are instructed to install and solder in place 47 tiny rivets. While tedious, this is a simple procedure. The rub comes when, in six places, you are required to solder a metal-cased mica capacitor to the circuit board, squarely on top of a rivet head. Due to the presence of the rivet, it is difficult to get the "continuous bonding" between capacitor and PC foil called for in the manual. A simple relocation of the six offending rivet holes would cure a minor but aggravating problem. As with all Heathkits, the best course is to follow the instructions as closely as possible.

With the VL-1180 temporarily installed in my car, alignment was a breeze, requiring about 15 minutes from start to finish. Tune-up is accomplished with a minimum of equipment: a 2-meter exciter, an swr meter, and a dummy load. Heath deserves a round of applause for designing an amplifier that is so easy to align; they even supply the necessary alignment tools. When aligned at 146 MHz, the output with 10-W drive was at least 80 W across the entire 2-meter band. One Watt of drive produced 9 Watts out. Input swr was less than 1.5:1 throughout the band.

The additional power provided by the VL-1180 has made all the difference in my FM mobile operations. No more humiliation when attempting to join the fun on the repeater! The amplifier has proven itself on SSB as well. I have spent many a Sunday afternoon atop our local drive-up mountain talking to the SSB boys on 144.2 MHz, using a portable five-element beam.

After more than six months of heavy use, the VL-1180 continues to perform well. Output power is unchanged from the original 80 Watts. The low standby current drain means that the amplifier can be left turned on at all times, unless the car isn't going to be driven for weeks on end.

Summary

Heath has done a nice job in creating an all-mode 2-meter linear kit that goes together without much difficulty and doesn't require a sophisticated test bench to align. A solution to the rivet problem should be considered, however, even if it's only to acknowledge it in the manual. Ideally, Heath should switch to a circuit board with plated-through holes.

The bottom line is, that despite minor construction difficulties, my VL-1180 worked the first time out and has worked ever since. It's hard to ask more from any piece of equipment. The VL-1180 is priced at $137.95 from *Heath Company, Benton Harbor MI 49022.* Reader Service number 475.

Jeff DeTray WB8BTH
73 Magazine Staff

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SATELLITES

PHASE IIIB LAUNCH DELAYED

We'll all have a bit more time to prepare for Phase III satellite activity. The European Space Agency (ESA) has announced a delay of at least two months in the flight that is scheduled to carry AMSAT's Phase IIIB satellite. At best, the launch will now occur in late September; it was originally set for July.

The problem is not with the Phase IIIB satellite or the Ariane launch vehicle, but with the design of the satellite that is to be the main payload on several Ariane launches. A similar satellite, MARECS-A, was launched in December and has developed some unexpected problems. Until the causes and cures for the problems can be determined, the scheduling of the Phase IIIB launch will remain uncertain.

TEN-TEC RIG

At the Dayton Hamvention in late April, Ten-Tec displayed a prototype of a rig designed to ease the average amateur into Phase III satellite communications, using the Mode B (435-144 MHz) transponder. The new unit contains a 10-W, 435-MHz CW/SSB transmitter and a 2-to-10-meter receive converter. Assuming you already have 10-meter receiving capability, you need only add antennas for 435 and 144 MHz to complete your Phase III satellite station. Ten-Tec doesn't plan to release the rig until Phase IIIB is safely aloft, i.e., sometime this fall.

ORBITAL CALENDARS

Project OSCAR, a California-based group of amateur satellite enthusiasts, has produced a comprehensive calendar of orbital predictions covering OSCAR 8 and all six Soviet RS satellites. This volume gives the time and longitude of the northbound equatorial crossing for each orbit of each satellite from May 1 through December 31, 1982. It's a must for satellite chasers. The calendar is available for an $8.75 donation. Your check or money order payable to Project OSCAR, Inc., should be mailed to POB 1136, Los Altos CA 94022. The price includes postage.

Thanks to *AMSAT Satellite Report* for some of the preceding information.—WB8BTH.

ORBITAL INFORMATION

OSCAR 8 Reference Orbits - July

Date	Time (UTC)	Eq. Crossing (Degrees West)
1	0132:12	95.3
2	0136:35	96.5
3	0140:59	97.6
4	0002:12	73.0
5	0006:36	74.2
6	0011:00	75.3
7	0015:23	76.5
8	0019:47	77.6
9	0024:11	78.8
10	0028:34	79.9
11	0032:58	81.1
12	0037:22	82.3
13	0041:45	83.4
14	0046:09	84.6
15	0050:33	85.7
16	0054:56	86.9
17	0059:20	88.0
18	0103:44	89.2
19	0108:07	90.4
20	0112:31	91.5
21	0116:55	92.7
22	0121:18	93.8
23	0125:42	95.0
24	0130:05	96.2
25	0134:29	97.3
26	0138:53	98.5
27	0000:06	73.8
28	0004:30	75.0
29	0008:53	76.1
30	0013:17	77.3
31	0017:41	78.5

OSCAR 8 Reference Orbits - August

Date	Time (UTC)	Eq. Crossing (Degrees West)
1	0022:04	79.6
2	0026:28	80.8
3	0030:52	81.9
4	0035:15	83.1
5	0039:39	84.3
6	0044:03	85.4
7	0048:26	86.6
8	0052:50	87.7
9	0057:14	88.9
10	0101:37	90.0
11	0106:01	91.2
12	0110:25	92.4
13	0114:48	93.5
14	0119:12	94.7
15	0123:36	95.8
16	0127:59	97.0
17	0132:23	98.1
18	0136:46	99.3
19	0141:10	100.5
20	0002:24	75.8
21	0006:47	77.0
22	0011:11	78.1
23	0015:34	79.3
24	0019:58	80.5
25	0024:22	81.6
26	0028:45	82.8
27	0033:09	83.9
28	0037:33	85.1
29	0041:56	86.2
30	0046:20	87.4
31	0050:44	88.6

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Backed by over 54 years of experience, Harvey continues to offer the broadest selection and finest service available for the amateur radio community. This experience has taught us that the ham needs special treatment and that is why Harvey has established a special division dedicated to the needs of the U.S. and foreign ham alike.

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Introducing

TVRO CIRCUIT BOARDS

Satellite Receiver Boards—Now in Stock

DUAL CONVERSION BOARD............$25.00
This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

SIX 47pF CHIP CAPACITORS
For use with dual conversion board..............**$6.00**

70 MHz IF BOARD....................$25.00
This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the HOWARD/COLEMAN TVRO Demodulator. The on-board bandpass filter can be tuned for bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

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This circuit takes the 70 MHz center frequency satellite TV signals in the 10 to 200 millivolt range, detects them using a phase locked loop, de-emphasizes and filters the result and amplifies the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

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This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8 MHz subcarrier and the Miller 9052 coil tunes for recovery of the audio.

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Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL........................$15.00

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INCLUDING DUAL AUDIO (2 single audio boards)

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MICROWAVE RECEIVER This receiver is tunable over a range of 1900 to 2500 MHz approximately, and is intended for amateur use. The local oscillator is voltage controlled, making the I.F. range approximately 54 to 88 MHz for standard TV set channels 2 thru 7.

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Start taking calls in curious places with the revolutionary, new Cordless *Escort*® Phone.

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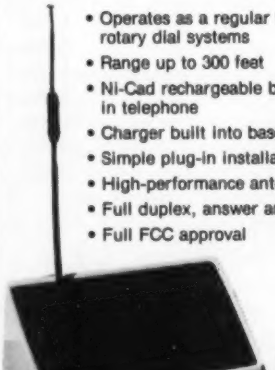

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- Charger built into base transmitter
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5.595-.500/4/CW	5.595MHz/.500KHz wide 4 pole CW	
5.595-2.7/LSB	5.595MHz/2.7KHz wide 8 pole lower sideband	
5.595-2.7/USB	5.595MHz/2.7KHz wide 8 pole upper sideband	
5.645-2.7/8	5.645MHz/2.7KHz wide 8 pole	Your Choice
9.0SB/CW	9.0MHz/ 8 pole sideband and CW	$12.99

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455KHz at Center Frequency of 453.5Kc Carrier Frequency of 455Kc 2.36Kc Bandwidth
$15.00

Crystal Filters

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Tyco/CD	001019880	10.7MHz 2 pole 15KHz Bw. Motorola #48D84396K01 Thru #48D84396K05	4.00
Motorola	4884863B01	11.7MHz 2 pole 15KHz Bandwidth	5.00
PTI	5350C	12MHz 2 pole 15KHz Bandwidth	5.00
PTI	5426C	21.4MHz 2 pole 15KHz Bandwidth	5.00
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	CFR455E	455KHz +- 5.5KHz	8.00
	CFU455E	455KHz +- 1.5KHz	2.90
	CFU455G	455KHz +- 1KHz	2.90
	CFW455D	455KHz +- 1KHz	2.90
	CFW455H	455KHz +- 3KHz	4.35
	SFB455D	455KHz	2.40
	SFE10.7	10.7MHz	2.67
	SFG10.7MA	10.7MHz	10.00
Clevite	TO-01A	455KHz	5.00
	TO-02A	455KHz	5.00
Nippon	LF-B4/CFU455I	455KHz +- 1KHz	5.80
	LF-B6/CFU455H	455KHz +- 1KHz	5.80
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Power Output	1dB Gain +7dBm	1dB Gain +20dBm	1dB Gain -5dBm	1dB Gain +8dBm
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Very High Level (+23dBm LO)   70KHz to 200MHz LO,RF,DC to 200MHz IF
Conversion Loss,dB One Octave From Band Edge 6Typ./7.5Max. Total Range 6.5Typ./8Max.
Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 55Typ./45Min. Mid. Range (LO-RF/LO-IF) 40Typ./30Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 30Typ./25Min.
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Isolation,dB Lower Band Edge To One Decade Higher (LO-RF/LO-IF) 60Typ./50Min. Mid. Range (LO-RF/LO-IF) 50Typ./35Min. Upper Band Edge To One Octave Lower (LO-RF/LO-IF) 35TYP./25Min.
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Collector Base Brakedown Voltage at Ic=100ua	35volts min.
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Collector Cutoff Current at Vcb=15v	100ua max.
Forward Current Transfer Ratio at Vce=15v,Ic=15ma	15min,40typ,125max
Transducer Power Gain at Vce=18v,Ice=60ma,F=2GHz.	3dBmin,4dBtyp
Maximum Available Gain at Vce=18v,Ic=60ma,F=1GHz/F=2GHz	14dB typ,8dB typ
Price $29.99	

Motorola RF Power Amplifier Modules

Model	MHW612A	MHW613A	MHW710	MHW720
Frequency Range	146 to 147MHz	150 to 174MHz	400 to 512MHz	400 to 470MHz
Voltage	12.5vdc	12.5vdc	12.5vdc	12.5vdc
Output Power	20watts	30watts	13watts	20watts
Minimum Gain	20dB	20dB	19.4dB	21dB
Harmonics	-30dB	-30dB	40dB	40dB
RF Input Power	400mw	500mw	250mw	250mw
Price	$57.50	$59.80	$57.50	$69.00

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"TRANSISTORS"

WATKINS JOHNSON WJ-M62 3.7 to 4.2GHz Communication Band Double Balanced Mixer $100.00

SSB Conversion Loss	4.9dB Typ. 6dB Max.	fR 3.7 to 4.2GHz
	5.5dB Typ. 6.5dB Max.	fI DC to 1125MHz fL fR
		fI 880MHz fL fR
SSB Noise Fiqure		fR 3.7 to 4.2GHz
	4.9dB Typ. 6dB Max.	fI 30 to 1125MHz fL fR
	5.5dB Typ. 6.5dB Max.	fI 880MHz fL fR
Isolation		
fL at R	30dB Min. 40dB Typ.	fL 2.8 to 5.35GHz
fL at I	25dB Min. 30dB Typ.	fL 4.5 to 5.35GHz
	20dB Min. 30dB Typ.	fL 3.6 to 4.5GHz
	15dB Min. 25dB Typ.	fL 2.8 to 3.6GHz
Conversion Compression	1dB Max.	fR Level +2dBm
Flatness	.2dB Peak to Peak Over any 40MHz Segment of fR=3.7 to 4.2GHz	
Third Order Input Intercept	+11dBm	fR1=4GHz fR2=4.01GHz Both at -5dBm fL=4.5GHz
Group Time Delay	.5ns Typ. .75ns Max.	fR3.7 to 4.2GHz fL 3480MHz @ +13dBm

VSWR	L-Port	1.25:1 Typ.	2.0:1	fL 2.8 to 5.35GHz
	R-Port	1.25:1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
		1.4 :1 Typ.	2.0:1	fR 3.7 to 4.2GHz fL fR
	I-Port	1.5 :1 Typ.	2.0:1	fI=100MHz
		1.3 :1 Typ.	2.0:1	fI=500MHz
		1.8 :1 Typ.	2.5:1	fI=1125MHz

SGS/ATES RF Transistors			Motorola RF Transistor	
Type.	BFQ85	BFW92	MRF901	2N6603
Collector Base V	20v	25v	25v	25v
Collector Emitter V	15v	15v	15v	15v
Emitter Base V	3v	2.5v	3v	3v
Collector Current	40ma	25ma	30ma	30ma
Power Dissipation	200mw	190mw	375mw	400mw
HFE	40min. 200max.	20min. 150max.	30min. 200max.	30min. 200max.
FT	4GHZ min. 5GHz max.	1.6GHz Typ.	4.5GHz typ.	2GHz min.
Noise Fiqure	1GHz 3dB Max.	500MHz 4dB Typ.	1GHz 2dB Typ.	2GHz 2.9dB Typ.
Price	$1.50	$1.50	$2.00	$10.00

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LM317K	LM350K	LM723G/L	LM7805/06/08/12/15/18/24
1.2 to 37vdc	1.2 to 33vdc	2 to 37vdc	5, 6, 8,12,15,18,24vdc
1.5Amps	3Amps	150ma.	1Amp
TO-3	TO-3	TO-100/TO-116	TO-220/TO-3
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P & B Solid State Relays Type ECT1DB72

5VDC Turn On 120VAC Contact 7Amps
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WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min	F=2GHz	dB 2.4 Typ.	MAG F=2GHz	dB 12 Typ.	$5.30
	F=3GHz	dB 3.4 Typ.	F=3GHz	dB 9 Typ.	
	F=4GHz	dB 4.3 Typ.	F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacutures and described in the Motorola RF Data Book.

10pf	22pf	30pf	40pf	100pf	250pf	1 to 10pcs.	.60¢ each
13pf	25pf	32pf	43pf	120pf	820pf	11 to 50pcs.	.50¢ each
14pf	27pf	33pf	62pf	180pf		51 to 100pcs.	.40¢ each
20pf	27.5pf	34pf	80pf	200pf			

NIPPON ELECTRIC COMPANY TUNNEL DIODES

			$7.50
		MODEL 1S2199	1S2200
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

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Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

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CHIP CAPACITORS

.8pf
1pf
1.1pf
1.4pf
1.5pf
1.8pf
2.2pf
2.7pf
3.3pf
3.6pf
3.9pf
4.7pf
5.6pf
6.8pf
8.2pf

10pf
12pf
15pf
18pf
20pf
22pf
24pf
27pf
33pf
39pf
47pf
51pf
56pf
68pf
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100pf*
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1001 & UP .35¢

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Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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4624	100.00
4665	350.00
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TUBES	PRICE
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DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

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INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, United Parcel only.

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PREPAID ORDERS: Order must be accompanied by a check.

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RESTOCK CHARGE: If parts are returned to MHZ Electronics due to customer error, customer will be held responsible for all extra fees, will be charged a 15% restocking fee, with the remainder in credit only. All returns must have approval.

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11C01FC	High Speed Dual 5/4 Input NO/NOR Gate	15.40
82S90	Presettable High Speed Decade/Binary Counter used with the 11C90/91 or the 95H90/91 Prescaler can divide by 100. (Signetics)	5.00
11C24DC	This chip is the same as a Motorola MC4024/4324 Dual TTL Voltage Control Multivibrator.	3.37
11C44DC	This chip is the same as a Motorola MC4044/4344 Phase Frequency Detector.	3.37

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y-2167
Freq. Gap (GHZ) 12 to 18, Output (Min.) 100mW, Duty (%) CW, Typ. Bias (Vdc) 8.0, Type. Oper. (MAdc) 550, Max. Thres. (mAdc) 1000, Max. Bias (Vdc) 10.0. **$39.99**

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Freq. Coverage 8 to 12.4GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias current (mAdc) Operating 550 Typ. 750 Max., Threshold 850 Tup. 1000 Max. **$39.99**

VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power +10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

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MODULAR AMPLIFIERS	Model UTO-504	UTO-511
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Input Power Vdc	+24	+15
mA	100	10
PRICE	$70.00	PRICE $75.00

HEWLETT PACKARD

MIXERS MODELS	10514A	10514B
Frequency Range	2MHz to 500MC	2MHz to 500MC
Input/Output Frequency L & R	200KHz to 500MC	200KHz to 500MC
X	DC to 500MC	DC to 500MC
Mixer Conversion Loss (A)	7dB	7dB
(B)	9dB	9dB
Noise Performance (SSB) (A)	7dB	7dB
(B)	9dB	9dB
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FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

The signal source are designed for applications where high stability and low noise are of prime concern. these sources utilize fundamental transistor oscillators with high Q coaxial cavities, followed by broadband stable step recovery diode multipliers. This design allows single screw mechanical adjustment of frequency over standard communications bands. Broadband sampling circuits are used to phase lock the oscillator to a high stability reference which may be either an internal self-contained crystal oscillator, external primary standard or VHF synthesizer. This unique technique allows for optimization of both FM noise and long term stability. List Price is $1158.00 (THESE ARE NEW) **Our Price—$269.**

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9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adaptor/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

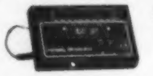
Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED



PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW
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SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

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ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

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- BNC Connectors
- Great for sniffing RF with pick-up loop

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SOCIAL EVENTS

from page 78

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FLAGSTAFF AZ
JUL 30-AUG 1

The Amateur Radio Council of Arizona will hold its 32nd annual hamfest from July 30 through August 1, 1982, at the Fort Tuthill Fairgrounds, just a few miles south of I-40, Flagstaff AZ. There will be thousands of dollars in prizes, improved XYL activities, a swapfest, a transmitter hunt, speakers, forums, awards, exhibits, and entertainment on Friday and Saturday nights. Overnight camping facilities will be available. Talk-in on 147.870/146.270. For further information, contact Wm. Oliver Grieve W7WGW, 4301 N. 31st Avenue, Phoenix AZ 85017, or call (602)-246-0200.

KINGSFORD MI
JUL 31-AUG 1

The Mich-A-Con ARC will hold the 34th annual UP Hamfest on Saturday, July 31, and Sunday, August 1, 1982, at the Dickinson County Armory on M-95, Kingsford MI. Tickets are $2.50 at the door (no advance sales) and registration will begin at 9:00 am on both days. There will be prizes, family activities, and a Saturday night banquet. Advance banquet reservations are needed since seating is limited. Plenty of free parking will be available. Talk-in on 146.25/.85 and .3922. For further information, write UPHAMFEST-82, 105 East Breitung Avenue, Kingsford MI 49801.

ANGOLA IN
AUG 1

The Steuben County Radio Amateurs will hold the 24th annual FM Picnic and Hamfest on Sunday, August 1, 1982, at Crooked Lake, Angola IN. Admission is $2.50. There will be prizes, picnic-style BBQ chicken, inside tables for exhibitors and vendors, and overnight camping. (A fee will be charged by county park.) Talk-in on 146.52 and 147.81/.21.

PITTSBURGH PA
AUG 1

The 45th annual South Hills Brass Pounders and Modulators Hamfest will be held on August 1, 1982, from 10:00 am to 4:00 pm, at South Campus, Community College of Allegheny County, Pittsburgh PA. Admission is $2.00 or 3 for $5.00. There will be computer, OSCAR, and ATV demonstrations, as well as a flea market. Talk-in on 146.13/.73 and 146.52. For further information, contact Andrew L. Pato WA3PBD, 1433 Schauffler Drive, West Homestead PA 15120.

BELVIDERE IL
AUG 1

The Big Thunder ARC will hold its annual hamfest on Sunday, August 1, 1982, at the Boone County Fairgrounds, Route 76, Belvidere IL. Admission is $2.00 in advance and $2.50 at the gate. A fee will be charged for 8-foot tables and there will be indoor space available in the exhibit building, as well as outdoor space in swappers' row. Sellers will be able to set up Saturday evening or at 7:00 am on Sunday. Features will include door prizes, a main prize, food, and refreshments. Camping will be available on Saturday evening (there will be a charge for electricity). Talk-in on 146.52 and 147.975/147.375. For further information or tickets, send an SASE to Jim Grimsby, 418 Beacon Drive, Belvidere IL 61008.

LEVELLAND TX
AUG 1

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will hold their 17th annual picnic and swapfest on Sunday, August 1, 1982, beginning at 8:00 am at the city park in Levelland TX. This event is for the entire family. Bring your own picnic basket for lunch at 12:30. A two-meter FM transceiver is the grand prize. A $3.00 registration is requested but not required. There will be swapping all day, with tables provided. Talk-in on .28/.88.

GLEN MI
AUG 1

The Black River Amateur Radio Club will hold the 29th annual Southwestern Michigan VHF Picnic on Sunday, August 1, 1982, at the West Side County Park near Glen MI. (Take exit 30 from I-196 and follow the signs.) There will be swimming, a playground, a small flea market, and door prizes. There is no food available at the park, so bring your own picnic basket. Registration is $1.00. For additional information, contact Ed Alderman KI8Z, RR #2, Box 44, Lawrence MI 49064.

POMONA CA
AUG 7

The Tri-County Amateur Radio Association will hold its annual hamfest/picnic on Saturday, August 7, 1982, from 7:00 am to 1:00 pm, at the Los Angeles County Fairgrounds, Pomona CA. All buyers, sellers, and computer buffs are welcome. There will be prizes, exhibits, and refreshments. Talk-in on 146.025/.625. For more information, write to TCARA Hamfest Chairman W6ELZ, PO Box 142, Pomona CA 91769.

JACKSONVILLE FL
AUG 7-8

The Greater Jacksonville Hamfest Association will hold the annual Jacksonville Hamfest and Northern Florida ARRL Convention on August 7-8, 1982, at the Orange Park Kennel Club, located near the intersection of I-295 and US 17 just south of Jacksonville. Advance registration is $3.50 and is available from Robert J. Cutting W2KGI, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Registration at the door is $4.00. The FCC will administer amateur and commercial radio operator exams on Friday, August 6th, at the hamfest site. Those wishing to take the exams should apply to the Atlanta FCC office as soon as possible. Swap tables are $12.00 per table for both days (no one-day tables) and table reservations, as well as advance registrations, are available from Andy Burton NX4G, 5101 Younis Road, Jacksonville FL 32218. A full slate of programs is scheduled, along with meetings of statewide and regional nets and organizations, plus competitions including a rabbit hunt and pileup contest. The headquarters hotel is the Best Western First National Inn just across from the hamfest. Special rates may be obtained by writing to Jim Canfield KD4CG, 996 Dostie Circle, Orange Park FL 32073. Talk-in on 146.16/.76 and 146.07/.67.

SAUK RAPIDS MN
AUG 8

The St. Cloud Radio Club will hold its annual hamfest on Sunday, August 8, 1982, from 8:30 am to 4:00 pm, at the Sauk Rapids Municipal Park, Sauk Rapids MN. Talk-in on 146.34/.94. For more information, contact Mike Lynch, 2115-1st Street, St. Cloud MN 56301, or call (612)-251-2297.

MONTGOMERYVILLE PA
AUG 8

The Mid-Atlantic Amateur Radio Club announces its annual J. B. M. Hamfest to be held on Sunday, August 8, 1982, from 9:00 am to 4:00 pm, rain or shine. Tailgate setup begins at 8:00 am. Located at the Route 309 Drive-In Theater, 1/4 mile north of Route 63, Montgomeryville, PA (6 miles north of the Fort Washington interchange of the Pennsylvania Turnpike). Admission: $2.50, with $1.00 additional for each tailgate space. Non-licensed XYLs and children admitted free. Ample parking, refreshments, raffles, door prizes, and more. Talk-in on WB3JOE/R (147.66/.06) or 146.52 simplex. For further information, write the club, PO Box 352, Villanova PA 19085.

TACOMA WA
AUG 14-15

The Radio Club of Tacoma will hold Hamfair 82 on August 14-15, 1982, at the Pacific Lutheran University campus, Tacoma WA. Registration is $5.00 and dinner is $7.50. Activities will include technical seminars, a flea market, commercial booths, an ARRL meeting, a repeater forum, a VHF tweak and tune clinic, prizes, raffles, and a loggers' breakfast. Talk-in on 147.88/.28. For more information, contact Grace Teitzel AD7S, 701 So. 120th, Tacoma WA 98444, or phone (206)-564-8347.

WILMINGTON DE
AUG 15

The scventh annual New Delmarva Hamfest will be held on Sunday, August 15, 1982, from 8:00 am to 4:00 pm at Gloryland Park, Bear DE (5 miles south of Wilmington). Admission is $2.25 in advance, $2.75 at the gate. Tailgating is $3.50. Limited tables will be available under the pavilion, but bring your own to be sure. Food and drinks will be available. First prize is an Atari® Home Video Game System. Talk-in on .52 and .13/.53. For more information and a map, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. For advance tickets, make checks payable to Delmarva Hamfest, Inc.

TIOGA COUNTY PA
AUG 21

The Tioga County PA ARC 6th Annual Amateur Radio Hamfest will be held on Saturday, August 21, 1982, from 0800 to 1600 at a new location at Island Park, just off US Rte. 15, Blossburg PA. There will be a flea market, food, free camping, an auction, an H/T door prize, etc. Talk-in on .19/.79 and .52. For more information or advance tickets, write Tioga Co. ARC, PO Box 56, Mansfield PA 16933, or contact Paul Sando KC2AZ, 606 Reynolds Street, Elmira NY 14904 on .19/.79 or .96/.36.

MARYSVILLE OH
AUG 21-22

The Union County Amateur Radio Club will hold the Marysville Hamfest on Saturday afternoon and all day Sunday, August 21-22, 1982, at the fairground in Marysville (near Columbus) OH. Admission is $2.00 in advance or $3.00 at the gate. Flea market space is $1.00. Food, beverages, and free overnight camping, movies, and popcorn will be available. Featured on Saturday night will be a free square dance (with a live band) followed by a big country breakfast available all night. Door prizes, ladies' programs, and ARRL, FCC, and MARS meetings will be featured on Sunday. Talk-in on 146.52 and 147.99/.39. For additional information, write UCARC, 13613 US 36, Marysville OH 43040, or call (513)-644-0468.

ST. CHARLES IL
AUG 22

The Fox River Radio League will host the Illinois State ARRL Convention in conjunction with its annual hamfest, both to be held on August 22, 1982, from 8:00 am to 4:00 pm, at the Kane County Fairgrounds, St. Charles IL. Tickets are $2.00 in advance and $3.00 at the gate. For advance tickets, send an SASE to J. Dubeck KA9HQY, 1312 Bluebell Lane, Batavia IL 60510. There will be commercial exhibits, a flea market, contests, demonstrations, forums, prizes, and hot food. Talk-in on 146.94. Exhibitors, dealers, and vendors should contact G. R. Isely WD9GIG, 736 Fellows Street, St. Charles IL 60174.

WENTZVILLE MO
AUG 22

The St. Charles Amateur Radio Club, Inc., will hold Hamfest 82 on August 22, 1982, at the Wentzville Community Center, Wentzville MO. Tickets in advance are $1.00 each or 4 for $3.00; at the door, they are $1.50 each or 4 for $5.00. Admission is $1.00 per car. There will be prizes, contests, a flea market, food, and air conditioned exhibitions buildings. For tickets, motel and camping information, prize lists, dealer reservations, etc., write SCARC Hamfest 82, c/o Mike McCrann WD0GSY, 25 Elm Street, St. Peters MO 63376.

SEWELL NJ
AUG 29

The Gloucester County Amateur Radio Club will hold its fourth annual GCARC Ham/Compfest on Sunday August 29, 1982, from 8:00 am to 3:00 pm at the Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance and $2.50 at the door. The tailgaters' and dealers' charge is $6.00 and includes one free admission. Doors will open at 7:00 am for setup. There will be speakers, seminars, contests, FCC exams, and prizes, including a Radio Shack TRS-80 computer and a Yaesu FT-208R. Talk-in on 146.52 and 147.78/.18. For more information, contact GCARC Hamfest Committee, PO Box 370, Pitman NJ 08017, or phone (609)-456-0500 or (609)-338-4841 (days) or (609)-629-2064 (evenings).

BUTLER PA
SEP 12

The Butler County Amateur Radio Association will hold its annual hamfest on Sunday, September 12, 1982, from 9:00 am to 4:00 pm, at the Butler Farmshow Grounds at Roe Airport, Butler PA. Fly-in at Butler Farmshow Airport. Admission is a $1.00 donation and children under 12 will be admitted free. Overnight campers are welcome and food and refreshments will be available. There will be an indoor flea market (vendor space will be $3.00 per 8-foot table), a free outside flea market, free parking (including for the handicapped), and prizes, including a Kenwood TS-8305 HF transceiver. Talk-in on 147.96/.36, .52, and 147.84/.24. For additional information, contact Leighton Fennell, Crestmont Drive, RD 6, Butler PA 16001, or phone (412)-586-9822.

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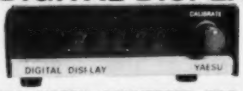

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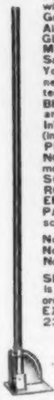

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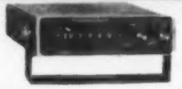

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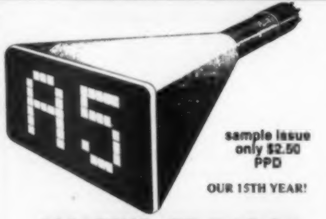

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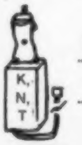

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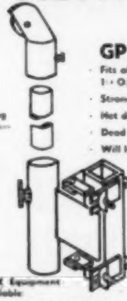
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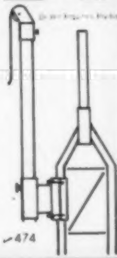

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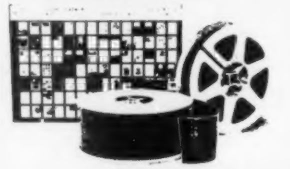

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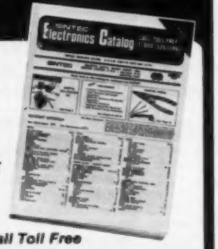

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Serial and Parallel I/O routines included.

Super Basic on Cassette $45.00.

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display ROM monitor;, fully expandable. **$419.00**. 4K version **$438.00**. 4K Assembler **$29.00**, 8K Basic Interpreter **$59.00**.

Special small power supply 5V 2A 24V .5A assem. in frame **$59.00**. Molded plastic enclosure to fit both AIM 65 and power supply **$52.50**. AIM 65 1K in cabinet with power supply, switch, fuse, cord assem. **$546.00**. 4K **$565.00**. **A65/40-5000 AIM 65/40 w/16K RAM and monitor $1295.00**. RAM Board Kit (16K, $195) (32K, $215). VD640 Video Interface Kit **$119.00**. A&T **$149.00**. Complete AIM 65 in thin briefcase with power supply **$507.00**. Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$598.00**

AIM 65/KIM/SYM/Super Elf 44 pin expansion board; board with 3 connectors **$22.95**. ***Send for complete list of all AIM products.**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00**.

Super Color S-100 Video Kit $99.00

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80, etc. **Dealers: Send for excellent pricing/margin program.**

TERMS: $5.00 min. order U.S. Funds. Calif. residents add 6% tax. $10.00 min. VISA and MasterCard accepted. $1.00 insurance optional. Shipping: Add 5%; orders under $25.00—10%.

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MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit	$14.95
FM-3 Wired and Tested	19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1
$8.95

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 **$7.95**

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.
Complete kit, BL-1
$2.95

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
Complete kit, BN-9 **$5.95**

CPO-1

Runs on 3-12 Vdc 1 watt out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit **$2.95**

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit **$3.95** FM-2 kit **$4.95**

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.
Complete kit, WL-1
$6.95

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 **$5.95**

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit **$5.95**

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit **$4.95**

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 **$2.95**

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma) 1 min/month accuracy TB-7 Kit **$5.50**
TB-7 Assy **$9.95**

CLOCK KITS

Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5	$24.95
Clock with 10 min. ID timer, 12/24 hour, DC-10	$29.95
Alarm clock, 12 hour only, DC-8	$29.95
12V DC car clock, DC-7	$29.95

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock

The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format	$22.95
DC-3 wired and tested	$29.95

Calendar Alarm Clock

The clock that's got it all: 6-.5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available)
DC-9 **$34.95**

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer atuomatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket	$27.95 kit
DM-1 dimmer adapter	$2.50

Add $10.00 Assy. and Test

Video Terminal

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char. by 16 lines, with scrolling, upper and lower case (optional) and has RS 232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416 terminal card kit (add $60.00 for wired unit)	$189.95
Lower Case option	$13.95
Power Supply	$14.95
RF Modulator kit	$7.95

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324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

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With info and specs	15/$1.00
6 Hole Balun Beads	5/$1.00

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FND 359 .4" C.C	$1.00
FND 507/510 .5" C.A	1.00
MAN 72/HP7730 .33" C.A	1.00
HP 7651 .43" C.A	2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

TRANSISTORS

2N3904 NPN C+F	15/$1.00
2N3906 PNP C+F	15/$1.00
2N4403 PNP C+F	15/$1.00
2N4410 NPN C+F	15/$1.00
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2N5401 PNP C+F	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type T+R	50/$2.50
PNP 3906 Type T+R	50/$2.50
2N3055	$.60
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP 100V Bridge $1.50 each

Mini-Bridge 50V 1 AMP 2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more **$1.50**

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

Switches

Mini toggle SPDT	$1.00
Red Pushbuttons N.O.	3/$1.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc
5 for $1.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc
3 for $2.00

Solid State Buzzers

small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible **$1.50**

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil. 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads
4/$1.00

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TANTALUM Dipped Epoxy		ALUMINUM Electrolytic		DISK CERAMIC	
1.5 uF 25V	3/$1.00	1000 uF 16V Radial	$.50	.01 16V disk	30/$1.00
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.22 uF 25V	3/$1.00	150 uF 16V Axial	5/$1.00	.001 16V	20/$1.00
		10 uF 15V Radial	10/$1.00	100 pF	20/$1.00
				.047 16V	20/$1.00

DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma **$1.25**

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot	$1.00
1K 20 Turn Trim Pot	$ .50

Trimmer Caps

Sprague - 3-40 pf
Stable Polypropylene
.50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge **$.75**

Mini RG-174 Coax
10 ft. for $1.00

Coax Connector

Chassis mount
BNC type **$1.00**

9 Volt Battery Clips

Nice quality clips	5 for $1.00
¼" Rubber Grommets	10 for $1.00

Parts Bag

Asst. of chokes, disc caps, tant., resistors, transistors, diodes, MICA caps etc
sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module
price **.75 ea.**

Leds

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red	8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green	6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - **.50 each or 3/$1.00**

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Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit	$29.95
PS-2 wired	$39.95

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify -10 or -100

Wired, tested, PS-1B	$59.95
Kit, PS-1B	$44.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit	$22.95
TR-1, RF sensed T-R relay kit	6.95

MRF-238 transistor as used in PA-1 8-10db gain 150 mhz **$11.95**

RF actuated relay senses RF (1W) and closes DPDT relay. For RF sensed T-R relay
TR-1 Kit **$6.95**

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V @ 1 A and 24 VCT.
Complete kit, PS-3LT **$6.95**

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 **10 for $2.00**

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78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size: 1" x ¼" shrink to ⅛". Great for splices **50/$1.00**

Mini TO-92 Heat Sinks

Thermalloy Brand	5 for $1.00
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Opto Isolators - 4N28 type	$.50 ea.
Opto Reflectors - Photo diode + LED	$1.00 ea.

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. **20 strips for $1.00**

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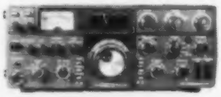
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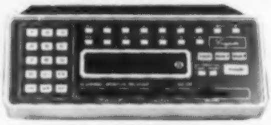
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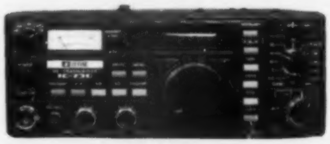
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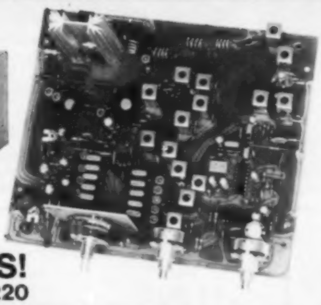

FM-5 PC Board Kit – **ONLY $159.95**
complete with controls, heatsink, etc.

★ **SPECIAL OFFER** Free cabinet kit, complete with speaker, knobs, connectors, hardware. A $59.95 value, yours free with purchase of kit. Hurry! Offer limited. ★

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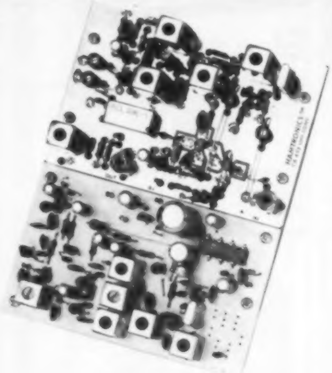

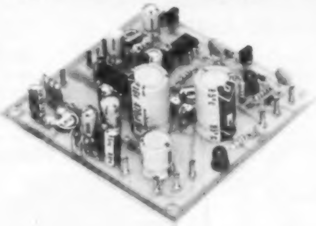

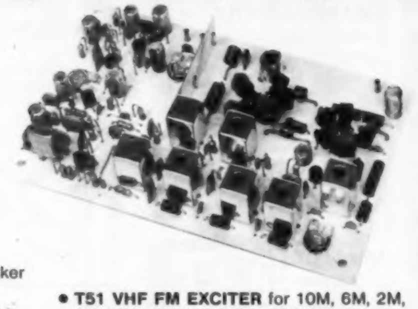

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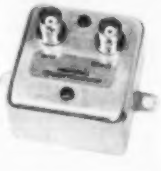
VHF & UHF RECEIVING CONVERTERS

20 Models cover every practical rf and if range to listen to SSB, FM, ATV, etc. on 6M, 2M, 220, 440, and 110 aircraft band. Even convert weather down to 2M! Kits from $39.95 and wired units.



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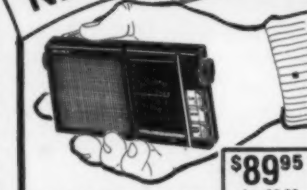

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$89.95 plus $3.00 shipping (Cont'l U.S.)

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ONLY $279.95 plus $5.00 shipping (Cont'l USA)

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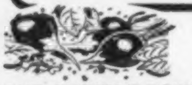
- 1/4-Mile range
- No license required



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We stock **Communications Specialists** SS-32 and SS-32M encoders for most any mobile or hand-held applications including the very popular **Icom Handhelds.**

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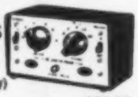

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Model PLF-2	$52.95
Model PLF-2E (240V)	$57.95
Model PT-2	$79.95
Model PT-2E (240V)	$84.95

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Add $5.00 for shipping (Cont'l U.S.A.)

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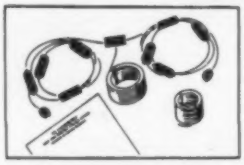
75/40HD/A	75/40 Mtr bands (66)	94.50
75-10HD/A	75/40/20/15/10 Mtr (66)	126.95
80-10HD/A	80/40/20/15/10 Mtr (69)	132.00



FAMOUS "EAVESDROPPER" SW RECEIVING ANTENNA

$59.95 plus $3.00 shipping (Cont'l U.S.)

VoCom POCKET POWER

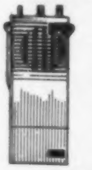
plus $8.00 shipping (Cont'l USA) $179.95

Accepts any version of the IC-2A, applies its output to a wide-band rf amplifier, and delivers 25 watts to your mobile antenna. Mobile talk-out power!

ICOM IC25A

NEW! IC3AT (220 MHz) IC4AT (440 MHz)

ICOM IC2A, IC2AT



- Compact
- Quality Construction
- Versatile
- Affordable
- Wide Range of Accessories Available

CALL FOR PRICE & AVAILABILITY

SPECIAL PURCHASE!

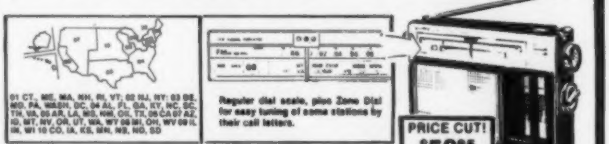
"REDISCOVER" AM BROADCAST LISTENING!

ORDER WHILE QUANTITIES LAST!

SONY ICF-S5W SUPER-SENSITIVE AM-FM PORTABLE

The ICF-S5W offers outstanding sensitivity and selectivity, which means better reception of weak, hard-to-tune signals and clean, clear reception in crowded dial areas. And, in the city or outlying rural areas, the ICF-S5W makes tuning simple. All stations can be tuned on the unit's regular dial scale. In addition, a special Zone Dial Selector helps you tune major stations by their call letters.

You simply select your broadcast zone, then pick the station by name without referring to dial-scale numerals. It's a lot of performance and convenience in a little radio, which projects rich, powerful sound through a big 4" speaker.



Regular dial scale, plus Zone Dial for easy tuning of some stations by their call letters.

PRICE CUT! $59.95 plus $5.00 shipping (Cont'l U.S.)

TO ORDER: CALL OR WRITE. MASTER CARD, VISA, MONEY ORDERS ACCEPTED. (PERSONAL CHECKS TAKE 3 WEEKS TO CLEAR.) **INTERNATIONAL ORDERS WELCOME,** PLEASE REQUEST PRO FORMA INVOICE. ILLINOIS RESIDENTS ADD 6% SALES TAX.

HOURS: MON. THRU WED. 9:30-6:00, THURS-FRI. 9:30-8:00, SAT. 9:30-3:00

STOP BY AND VISIT WHEN IN THE CHICAGOLAND AREA!!

SPECTRONICS, INC.

1009 GARFIELD ST. OAK PARK, IL. 60304

PHONE (312)848-6777

VISA

7400

SN7400N	.20	SN7472N	.29	SN74156N	.79
SN7401N	.20	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7479N	5.00	SN74163N	.89
SN7406N	.35	SN7480N	.50	SN74164N	.89
SN7407N	.35	SN7482N	.99	SN74165N	.89
SN7408N	.29	SN7483N	.69	SN74166N	1.25
SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.29	SN7489N	1.75	SN74172N	4.95
SN7412N	.35	SN7490N	.49	SN74173N	1.39
SN7413N	.40	SN7491N	.50	SN74174N	.99
SN7414N	.69	SN7492N	.45	SN74175N	.89
SN7416N	.29	SN7493N	.45	SN74176N	.79
SN7417N	.29	SN7494N	.69	SN74177N	.79
SN7420N	.25	SN7495N	.69	SN74179N	1.49
SN7421N	.29	SN7496N	.69	SN74180N	.79
SN7422N	.45	SN7497N	3.00	SN74181N	2.25
SN7423N	.29	SN74100N	1.49	SN74182N	.79
SN7425N	.29	SN74104N	.89	SN74184N	2.49
SN7426N	.29	SN74105N	.89	SN74185N	2.49
SN7427N	.25	SN74107N	.35	SN74190N	1.25
SN7428N	.49	SN74109N	.39	SN74191N	1.25
SN7430N	.25	SN74116N	1.95	SN74192N	.89
SN7432N	.29	SN74121N	.39	SN74193N	.89
SN7437N	.25	SN74122N	.55	SN74194N	.89
SN7438N	.40	SN74123N	.59	SN74195N	.69
SN7439N	.25	SN74125N	.49	SN74196N	.89
SN7440N	.20	SN74126N	.49	SN74197N	.89
SN7441N	.89	SN74132N	.75	SN74198N	1.49
SN7442N	.50	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	3.25	SN74251N	.99
SN7445N	.89	SN74143N	3.49	SN74276N	1.95
SN7446N	.79	SN74144N	3.49	SN74279N	.79
SN7447N	.69	SN74145N	.79	SN74283N	1.49
SN7448N	.79	SN74147N	1.95	SN74284N	3.95
SN7450N	.20	SN74148N	1.29	SN74285N	3.95
SN7451N	.20	SN74150N	1.25	SN74365N	.69
SN7453N	.20	SN74151N	.65	SN74366N	.69
SN7454N	.20	SN74152N	.69	SN74367N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74156N	.79	SN74393N	1.49

74LS

74LS00	.29	74LS92	.75	74LS192	1.15
74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.99	74LS194	1.15
74LS03	.29	74LS96	1.15	74LS195	1.15
74LS04	.35	74LS107	.45	74LS197	1.19
74LS05	.35	74LS109	.45	74LS221	1.19
74LS08	.35	74LS112	.45	74LS240	1.49
74LS09	.35	74LS113	.49	74LS241	1.49
74LS10	.35	74LS114	.49	74LS242	1.49
74LS11	.39	74LS122	.89	74LS243	1.49
74LS12	.35	74LS123	1.25	74LS244	1.49
74LS13	.59	74LS125	.99	74LS245	2.95
74LS14	.99	74LS126	.59	74LS247	1.19
74LS15	.35	74LS132	.99	74LS248	1.19
74LS20	.35	74LS133	.89	74LS249	1.19
74LS21	.35	74LS136	.49	74LS251	.99
74LS22	.35	74LS138	.89	74LS253	.99
74LS26	.39	74LS139	.89	74LS257	.89
74LS27	.35	74LS151	.89	74LS258	.69
74LS28	.35	74LS153	.89	74LS260	.69
74LS30	.35	74LS154	1.75	74LS266	.69
74LS32	.35	74LS155	.89	74LS273	1.95
74LS33	.59	74LS156	.89	74LS279	.89
74LS37	.45	74LS157	.89	74LS283	.89
74LS38	.39	74LS158	.89	74LS290	.99
74LS40	.35	74LS160	1.15	74LS293	.99
74LS42	.69	74LS161	1.15	74LS298	1.25
74LS47	.89	74LS162	1.15	74LS352	1.29
74LS48	1.15	74LS163	1.15	74LS353	1.29
74LS49	1.15	74LS164	1.15	74LS365	.69
74LS51	.35	74LS166	1.15	74LS366	.69
74LS54	.35	74LS168	1.19	74LS367	.69
74LS55	.35	74LS169	1.19	74LS368	.69
74LS73	.45	74LS170	1.95	74LS373	1.95
74LS74	.45	74LS173	.99	74LS374	1.95
74LS75	.59	74LS174	.99	74LS375	.89
74LS76	.45	74LS175	.99	74LS386	.69
74LS78	.49	74LS181	2.95	74LS393	2.49
74LS83	.89	74LS190	1.25	74LS399	2.49
74LS85	1.25	74LS191	1.25	74LS670	2.49
74LS86	.49			81LS95	1.95
74LS90	.69			81LS97	1.95

74S

74S00	.45	74S124	3.95	74S243	3.25
74S02	.45	74S133	.55	74S244	3.25
74S03	.45	74S134	.69	74S251	1.45
74S04	.55	74S135	1.19	74S253	1.45
74S05	.55	74S136	1.75	74S257	1.35
74S08	.50	74S138	1.35	74S258	1.35
74S09	.50	74S139	1.35	74S260	.79
74S10	.45	74S140	.79	74S280	2.95
74S11	.45	74S151	1.35	74S287	3.25
74S15	.45	74S153	1.35	74S288	2.75
74S20	.45	74S157	1.35	74S373	3.49
74S22	.45	74S158	1.35	74S374	3.49
74S30	.45	74S160	2.95	74S387	2.95
74S32	.55	74S174	1.59	74S471	10.95
74S38	1.25	74S175	1.59	74S472	10.95
74S40	.50	74S188	2.95	74S473	10.95
74S51	.45	74S194	1.95	74S474	12.95
74S64	.50	74S195	1.95	74S475	12.95
74S65	.50	74S196	1.95	74S570	5.95
74S74	.75	74S240	2.95	74S571	5.95
74S86	.79	74S241	2.95	74S572	9.95
74S112	.79	74S242	3.25	74S573	9.95
74S113	.79			74S940	3.15
74S114	.79			74S941	3.15

CA–LINEAR

CA3010H	.99	CA3060N	3.25	CA3089N	3.75
CA3013H	2.15	CA3080H	1.25	CA3096N	3.95
CA3023H	3.25	CA3081N	2.00	CA3130H	1.39
CA3035H	2.49	CA3082N	2.00	CA3140H	1.25
CA3039H	1.35	CA3083N	1.60	CA3160H	1.25
CA3046N	1.30	CA3086N	.85	CA3401N	.59
CA3059N	3.25			CA3600N	3.50

CD–CMOS

CD4000	.39	CD4041	1.49	CD 4098	2.49
CD4001	.39	CD4042	.99	CD4506	.75
CD4002	.39	CD4043	.89	CD4507	.99
CD4006	1.19	CD4044	.89	CD4508	3.95
CD4007	.25	CD4046	1.79	CD4510	1.39
CD4009	.49	CD4047	2.50	CD4511	1.29
CD4010	.49	CD4048	1.35	CD4512	1.49
CD4011	.39	CD4049	.49	CD4514	3.95
CD4012	.25	CD4050	.69	CD4515	2.95
CD4013	.49	CD4051	1.19	CD4516	1.49
CD4014	1.39	CD4052	1.19	CD4518	1.79
CD4015	1.19	CD4053	1.19	CD4519	.89
CD4016	.59	CD4056	2.95	CD4520	1.29
CD4017	1.19	CD4059	9.95	CD4526	1.79
CD4018	.99	CD4060	1.49	CD4528	1.79
CD4019	.49	CD4066	.79	CD4529	1.95
CD4020	1.19	CD4068	.39	CD4543	2.79
CD4021	1.39	CD4069	.45	CD4562	11.95
CD4022	1.19	CD4070	.55	CD4566	2.79
CD4023	.29	CD4071	.49	CD4583	2.49
CD4024	.79	CD4072	.49	CD4584	.75
CD4025	.23	CD4073	.39	CD4723	1.95
CD4026	2.95	CD4075	.39	CD4724	1.95
CD4027	.69	CD4076	1.39	MC14409	17.95
CD4028	.89	CD4078	.55	MC14410	18.95
CD4029	1.49	CD4081	.39	MC14411	15.95
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CD4034	3.49	CD4093	.99	MC14419	7.95
CD4035	.99			MC14433	15.95
CD4040	1.49			MC14538	2.49
				MC14541	1.95

A-AMBER —**LEDS**— G-GREEN
R-RED Y-YELLOW C-CLEAR

OPTO ELECTRONICS

DIFFUSED BI-COLOR/TRI-STATE

POINT SOURCE (RED)

DIFFUSED

DIFFUSED

WIDE ANGLE DIFFUSED

DIFFUSED

POINT SOURCE

DIFFUSED

DIFFUSED TRIANGLE

DIFFUSED RECTANGULAR

LED Mounting Hardware

Mounts in panels up to .125" thick. Drill .257" diameter hole (F Drill). Can be used with XC22, XC111, XC526, XC584 and XC556 Series (from .160" to .200 Dia.) Black plastic clip and ring.

Part No.	1-99	100+
LMH-200	8/$1.00	.08 ea.

—DISPLAY LEDS—

Part No.	Size	Color	Description	Price
MAN 1	270	Red	C.A. (LHDP)	$2.95
MAN 2	320	Red	5x7 Alphanumeric (TIL305)	4.95
MAN 52	300	Green	C.A. (LHDP)	.99
MAN 54	300	Green	C.C. (RHDP)	.99
MAN 72	300	Red	C.A. (LHDP)	.75
MAN 74	300	Red	C.C. (RHDP)	1.25
NSN 74L	300	Red	C.C. (LHDP)	.99
MAN 82	300	Yellow	C.A. (LHDP)	.49
MAN 84	300	Yellow	C.C. (RHDP)	.99
MAN 3620	300	Orange	C.A. (LHDP)	.49
MAN 3630	300	Orange	C.A. (±1) Over Flo	.99
MAN 4610	400	Orange	C.A. (RHDP)	.99
MAN 6610	[illegible]	Orange	C.A. (RHDP) 2 Digit	[illegible]
MAN 6630	[illegible]	Orange	C.A. (±1) 1½ Digit	[illegible]
MAN 6640	[illegible]	Orange	C.C. (RHDP) 2 Digit	[illegible]
MAN 6650	[illegible]	Orange	C.C. (±1) 1½ Digit	[illegible]
MAN 6680	[illegible]	Orange	C.A. (RHDP)	[illegible]
MAN 6710	[illegible]	Red	C.A. (RHDP) 2 Digit	[illegible]
MAN 6740	[illegible]	Red	C.C. (RHDP) 2 Digit	[illegible]
MAN 6750	[illegible]	Red	C.C. (±1) 1½ Digit	[illegible]
DL 34M	110	Red	C.C. (4 Digit Bubble) RHDP	[illegible]
DLO [illegible]	300	Orange	C.C. (RHDP)	1.25
DLO 307	300	Orange	C.A. (LHDP)	1.25
DLG [illegible]	[illegible]	Green	C.C. (RHDP)	1.25
DLG 507	[illegible]	Green	C.A. (RHDP)	1.25
DL [illegible]	[illegible]	Red	C.C. (RHDP)	1.25
DL 707	[illegible]	Red	C.A. (LHDP)	1.25
DL 747	[illegible]	Red	C.A. (LHDP)	1.49
DL 750	[illegible]	Red	C.C. (LHDP)	1.49
FND [illegible]	357	Red	C.A. (RHDP)	.75
FND 357	357	Red	C.C. (RHDP) FND 359	.75
FND 500	500	Red	C.C. (RHDP) FND 500	.99
FND 507	500	Red	C.A. (RHDP) FND 510	.99
TIL [illegible]	270	Red	Numerical Display w/Logic	10.95
TIL 311	270	Red	4x7 Hexadecimal w/Logic	10.95
5082-7300	600	Red	4x7 Numeric (RHDP)	$22.00
5082-7302	600	Red	4x7 Numeric (LHDP)	22.00
5082-7304	600	Red	Over Flo (±1) for 5082-7300 or	19.95
5082-7340	600	Red	4x7 Hexadecimal (0-9/A-F)	22.00
5082-7432	110	Red	C.C. (2-Digit/3-Bubble)	[illegible]
HDSP-3401	800 20mm	Red	C.A. (RHDP)	1.99
HDSP-3403	800 20mm	Red	C.C. (RHDP)	1.99
HDSP-3406	800 20mm	Red	C.C. (RHDP) ±1 Over Flo	1.99

Many Other Displays Available — Send for New Catalog

—OPTO-ISOLATORS—

H11C3	SCR Output Opto-Isolators	$1.10
LIT-1	Single Chan. 20% CTR. 2500V (MCT-2/4N25)	.69
4N26	Single Chan. 10% CTR. 500V (Photo-Transistor)	.69
4N33	Single Chan. 500% 1500V (Photo-Darlington)	1.25
MOC3010	Optically Isolated Triac Driver	1.25

LITRONIX-NATIONAL Stick Display Sale

LIMITED QUANTITY!

LED NUMERIC ARRAYS

PART NO.	DIGIT SIZE (INCH)	FORMAT	DRIVE Comm. Cathode/Comm. Anode	OVERALL SIZE	PRICE	SALE PRICE!
[illegible]	.100 (6 Bubble Stick)	888888	C.C. 6 Digit Multiplexed	2"L x .72"H x .27"D	$ .59	2/.99
NSA1[illegible]	.100 (9 Bubble Stick)	888888888	C.C. 9 Digit Multiplexed	2"L x .72"H x .27"D	.69	2/.99
NSA2[illegible]	.100 (9 Bubble Stick)	888888888	C.C. 9 Digit Multiplexed	1.60"L x .72"H x .27"D	.69	2/.99
NSA1[illegible]	.100 (9 Bubble Stick)	8 88 88	C.C. 5 Digit Multiplexed	2"L x .72"H x .27"D	.49	2/.59

*Standard Stocked Items

MULTI-DIGIT LED NUMERIC DISPLAYS

PART NO.	DIGIT SIZE (INCH)	FORMAT	DRIVE Comm. Cathode/Comm. Anode	OVERALL SIZE	PRICE	SALE PRICE!
NSN373	.3 No Decimal	88	C.C. 2 Digit Direct	.60"L x .80"H x .225"D	$ .49	2/.79
NSN374	.3 No Decimal	88	C.A. 2 Digit Direct	.60"L x .80"H x .225"D	.79	2/.99
[illegible]	.5 No Decimal	88	C.A. 2 Digit Direct	1.40"L x 1.14"H x .32"D	.89	2/1.49
NSN781	.7	88	C.C. 2 Digit Multiplexed	1.2"L x 1.25"H x .3"D	1.19	2/1.95
[illegible]	.3	88 88 + 8888	C.C. 8 Digit (10 Spaces)	4"L x .80"H x .280"D	.75	2/.89
[illegible]	.3	8888	C.A. 4 Digit Multiplexed	1.50"L x .80"H x .25"D	.75	2/.89
[illegible]	.3	+1888	C.A. 3½ Digit Multiplexed	1.00"L x .80"H x .225"D	.89	2/1.49
[illegible]	.3	88 88	C.C. 4 Digit – Colon/PM Indicator	1-9/16"L x 13/16"H x 3/16"D	.99	2/1.19
[illegible]	.3	88 88 88	C.C. 6 Digit – AM/PM, Failure Ind.	3"L x 1.10"H x 7/32"D	2.95	2/3.95
[illegible]	.3	88888888	C.C. 8 Digit Multiplexed	3"L x 1-3/32"H x 3/16"D	2.95	2/3.95
[illegible]*	.3	8888	C.C. 4 Digit Multiplexed	1.50"L x .80"H x .225"D	2.95	2/4.95
[illegible]*	.3	8888	C.A. 4 Digit Multiplexed	1.50"L x .80"H x .225"D	2.95	2/4.95
[illegible]*	.5	+1888	C.A. 3½ Digit Multiplexed	1.00"L x 1.00"H x .20"D	3.49	2/5.95
[illegible]	.5	88 88	C.C. 4 Digit – AM/PM, Colon Ind.	3.00"L x 1.10"H x .282"D	2.95	2/3.95
[illegible]*	.5	8888	C.C. 4 Digit Multiplexed	1.80"L x 1.00"H x .280"D	3.49	2/5.95
[illegible]*	.5	8888	C.A. 4 Digit Multiplexed	1.80"L x 1.00"H x .280"D	3.49	2/5.95
[illegible]	.5	+8888	C.C. 3½ Digit Multiplexed	3.00"L x 1.10"H x .282"D	2.49	2/3.49
[illegible]	.5	88888	C.A. 5 Digit Multiplexed	3.00"L x 1.10"H x .282"D	2.95	2/3.49
[illegible]	.7	888888	C.C. 6 Digit Multiplexed/Direct	3.60"L x 1.35"H x .282"D	3.95	2/4.95
[illegible]	.3	88	C.C. 2 Digit Multiplexed	13/16" x 7/8" x 1/4"	.79	2/.99
[illegible]	.5 (Green)	88	C.A. 2 Digit Multiplexed	1-5/16" x 1-1/2" x 5/16"	.89	2/1.10
[illegible]	1.0	888	C.A. 3 Digit Multiplexed	2-3/4" x 1-13/16" x 5/16"	2.25	2/3.49
[illegible]	.5	8888	C.C. 4 Digit, MPX, Colon	3-3/16" x 1-1/4" x 5/16"	1.95	2/2.95
[illegible]	.5	8888	C.C. 4 Digit, MPX, Colon	3-3/16" x 1 x 5/16"	1.75	2/2.95
[illegible]	.5 (Green)	8888	C.C. 4 Digit Non-Multiplexed	3-3/16" x 1 x 5/16"	4.95	2/7.95
[illegible]	.5	8888	C.C. 4 Digit Multiplexed	2" x 1-5/16" x 5/16"	1.49	2/1.95
[illegible]	.5	8888	C.C. 4 Digit Non-Multiplexed	3-3/16" x 1" x 5/16"	2.49	2/3.95

COMPUTER GRADE CAPACITORS

1¢ SALE!

MFD	WVDC	PRICE	MFD	WVDC	PRICE	MFD	WVDC	PRICE
250	100	1.95	7,000	60	4.95	27,000	10	2.95
500	200	2.49	10,000	15	2.95	32,000	25	4.95
1,200	3	.99	10,000	16	3.95	40,000	25	5.95
1,500	25	1.95	11,000	10	4.95	42,000	10	4.95
1,500	50	2.95	13,000	16	2.95	43,000	10	5.95
2,000	10	2.95	14,000	13	2.95	45,000	5	5.95
2,100	200	2.95	14,000	20	3.95	52,000	20	5.95
2,250	100	3.95	18,000	10	3.95	55,000	15	5.95
2,300	30	2.95	20,000	20	2.95	58,000	20	5.95
2,500	15	2.95	21,000	15	3.95	65,000	10	7.95
3,000	25	1.95	22,000	15	4.95	73,000	5	7.95
3,500	40	3.95	23,000	7	1.95	80,000	15	9.95
4,000	50	3.95	23,000	10	2.95	90,000	10	8.95
5,000	25	4.49	23,000	20	3.95	120,000	15	10.95
6,100	40	2.49	24,000	20	2.95	160,000	10	8.95

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LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.25	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

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Custom Jumpers!

Custom Cables!

STANDARD DIP JUMPERS

All jumpers use low profile dip plugs with heavy duty pins for repeated disconnect applications.

JAMECO Part No.	AP Cross-Reference	No. Pins	Description	Wire Length	Price
DJ14-1	924102-12	14	single end	12"	$1.70
DJ14-2	924102-24	14	single end	24"	2.05
DJ14-3	924102-36	14	single end	36"	2.35
DJ14-1-14	924106-12	14	double end	12"	3.20
DJ14-2-14	924106-24	14	double end	24"	3.49
DJ14-3-14	924106-36	14	double end	36"	3.79
DJ16-1	924112-12	16	single end	12"	1.85
DJ16-2	924112-24	16	single end	24"	2.19
DJ16-3	924112-36	16	single end	36"	2.50
DJ16-1-16	924116-12	16	double end	12"	3.35
DJ16-2-16	924116-24	16	double end	24"	3.60
DJ16-3-16	924116-36	16	double end	36"	4.05
DJ24-1	924122-12	24	single end	12"	2.00
DJ24-2	924122-24	24	single end	24"	3.30
DJ24-3	924122-36	24	single end	36"	3.95
DJ24-1-24	924126-12	24	double end	12"	4.79
DJ24-2-24	924126-24	24	double end	24"	5.29
DJ24-3-24	924126-36	24	double end	36"	5.89

JAMECO Part No.	AP Cross-Reference	No. Pins	Description	Wire Length	Price
DJ40-1	924132-12	40	single end	12"	5.89
DJ40-2	924132-24	40	single end	24"	6.79
DJ40-3	924132-36	40	single end	36"	7.00
DJ40-1-40	924136-12	40	double end	12"	10.95
DJ40-2-40	924136-24	40	double end	24"	11.89
DJ40-3-40	924136-36	40	double end	36"	12.79

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DB25S-4	4 feet	1-DB25S	10.95 ea.
DB25P-4-P	4 feet	2-DB25P	16.95 ea.
DB25P-4-S	4 feet	1-DB25P/1-DB25S	17.95 ea.
DB25S-4-S	4 feet	2-DB25S	18.95 ea.

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INTERSIL

*Evaluation Kits

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter CA	12.95
7217AIPI	4-Digit LED Up/Down Counter CC	14.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	6.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39	74C95	1.59	74C221	1.95
74C02	.39	74C107	1.89	74C240	2.25
74C04	.39	74C151	2.95	74C244	2.25
74C08	.39	74C154	3.95	74C373	2.49
74C10	.39	74C157	2.25	74C374	2.59
74C14	.75	74C160	1.69	74C901	.69
74C20	.39	74C161	1.69	74C903	.69
74C30	.39	74C162	1.49	74C911	10.95
74C32	.39	74C163	1.69	74C912	10.95
74C42	1.29	74C164	1.59	74C915	1.69
74C48	1.95	74C173	1.39	74C917	10.95
74C73	.79	74C174	1.39	74C922	5.49
74C74	.79	74C175	1.19	74C923	5.75
74C85	1.95	74C192	1.69	74C925	7.50
74C86	.99	74C193	1.69	74C926	7.50
74C89	6.95	74C195	1.59	80C95	.79
74C90	1.29			80C97	.79
74C93	1.29				

LINEAR

LH0002CN	6.85	LM340T-5	1.25	NE571N	3.95
LM10CLH	4.50	LM340T-12	1.25	LM703CN	.89
LM11CLH	4.75	LM340T-15	1.25	LM709N	.29
LH0070-OH	4.95	LM341P-5	.75	LM710N	.79
TL071CP	.79	LM341P-12	.75	LM711N	.79
TL072CP	1.39	LM341P-15	.75	LM723N	.69
TL074CN	2.49	LM342P-5	.69	LM733N	1.00
LH0082CD	35.00	LM342P-12	.69	LM739N	1.19
TL082CP	1.19	LM342P-15	.69	LM741CN	.35
TL084CN	2.19	LM348N	1.25	MC1741SCG	3.00
LH0094CD	35.00	LM350K	5.75	LM747N	.79
LM300H	.99	LF351N	.60	LM748N	.59
LM301CN	.35	LF353N	1.00	LM1014N	2.75
LM302H	1.95	LF355N	1.10	LM1310N	1.95
LM304H	1.95	LF356N	1.10	LM1458CN	.59
LM305H	.99	LM358N	1.00	LM1488N	1.25
LM307CN	.45	LM359N	1.79	LM1489N	1.25
LM308CN	1.00	LM370N	4.49	LM1496N	1.95
LM309H	1.95	LM373N	3.25	LM1556V	1.75
LM309K	1.25	LM377N	2.95	LM1800N	2.95
LM310CN	1.75	LM380N	1.25	LM1871N	5.49
LM311/CN	.90	LM381N	1.95	LM1872N	5.49
LM312H	2.49	LM382N	1.79	LM1877N-9	3.25
LM317MP	1.15	LM386N	1.95	LM1889N	3.20
LM317T	1.75	LM386N-3	1.29	LM1896N	1.75
LM317K	3.95	LM387N	1.45	LM2002T	1.49
LM318CN	1.95	LM389N	1.35	LM2877P	2.05
LM319N	1.95	LM392N	.69	LM2878P	2.25
LM320K-5	1.35	LF398N	4.00	LM2896P-1	2.25
LM320K-12	1.35	LM399H	5.00	LM3189N	2.95
LM320K-15	1.35	TL494CN	4.49	LM3900N	.69
LM320T-5	1.25	TL496CP	1.75	LM3905CN	1.25
LM320T-12	1.25	NE510A	6.00	LM3909N	1.15
LM320T-15	1.25	NE529A	4.95	LM3914N	3.95
LM323K	5.95	NE531H	3.95	LM3915N	3.95
LM324N	.99	NE536H	6.00	LM3916N	3.95
LM329DZ	.65	NE540H	6.00	RC4136N	1.25
LM331N	3.95	NE544N	4.95	RC4151NB	3.95
LM334Z	1.30	NE550A	1.30	RC4194TK	6.95
LM335Z	1.40	NE555V	.39	RC4195TK	5.49
LM336Z	1.75	LM556N	.99	LM4500A	3.25
LM337T	1.95	NE564N	3.95	ICL8038B	4.95
LM337MP	1.15	LM565N	1.25	LM13080N	1.29
LM338K	6.95	LM566CN	1.95	LM13600N	1.49
LM339N	.99	LM567V	1.25	75138N	1.95
LM340K-5	1.35	NE570N	4.95	75480N	.89
LM340K-12	1.35			75451CN	.39
LM340K-15	1.35			75492	.89

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50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/25V	.51	.46	.36
.22/35V	.39	.34	.29	3.3/25V	.63	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.56
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/16V	.79	.69	.56

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.16	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.16	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.16	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.46	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

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PROPAGATION

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	21	21	21A	21	21
AUSTRALIA	21	14	14	14	7	7	7	7	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	14	14	14	21	21	21
ENGLAND	14	14	7A	7	7	7A	14	14	21	21	14A	14
HAWAII	21	14	14	14	7	7	7	14	14	14	21	21
INDIA	14	14	14	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
MEXICO	14A	14	14	7A	7	7	7A	14	14	14A	21	21
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14A	14	7A	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	14	14	14	14A	21	21A	21A	21	14
U. S. S. R.	14	14	7	7	7	14	14	14	14	14	14A	14
WEST COAST	21	14A	14	14	7	7	7	14	14A	14A	21	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	14	21	21A	21	21
AUSTRALIA	21	14	14	14	7A	7	7	7	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	14	14	14	21	21	21
ENGLAND	14	14	7	7	7	7	14	14	14A	14A	14	14
HAWAII	21	14A	14	14	14	7	7	14	14	21	21	21
INDIA	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14	14	14	14	7B	7B	7B	14B	14	14	14	14
MEXICO	14	14	7A	7	7	7	7	7A	14	14	14A	14A
PHILIPPINES	14	14	14	14B	7B	7B	7B	7B	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	7B	7B	14B	14	14	14	14A	14A	14
U. S. S. R.	14	14	7	7	7	7B	14B	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	14	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	14	7	14	14	21	21A	21	21
AUSTRALIA	21A	21	21	14	14	14	14	14	7	7	14A	21
CANAL ZONE	21A	21	14	14	7A	7	7	14	14	14A	21	21
ENGLAND	14	14	7	7	7	7	7	14	14	14	14	14
HAWAII	21A	21	21	14	14	14	14	14	14	21	21	21A
INDIA	14	14	14	14	14B	7B	7B	7B	14	14	14	14
JAPAN	14A	14	14	14	14	14B	7B	14	14	14	14	14
MEXICO	14A	14	14	7A	7	7	7	14	14	14A	21	14A
PHILIPPINES	14A	14	14	14	14	14B	7B	7B	14	14	14	14
PUERTO RICO	21	21	14	14	7	7	7A	14	21	21	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	7B	14	14	14	14A	14
U. S. S. R.	14	14	7	7	7	7B	7B	14B	14	14	14	14
EAST COAST	21	14A	14	14	7	7	7	14	14A	14A	21	21

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

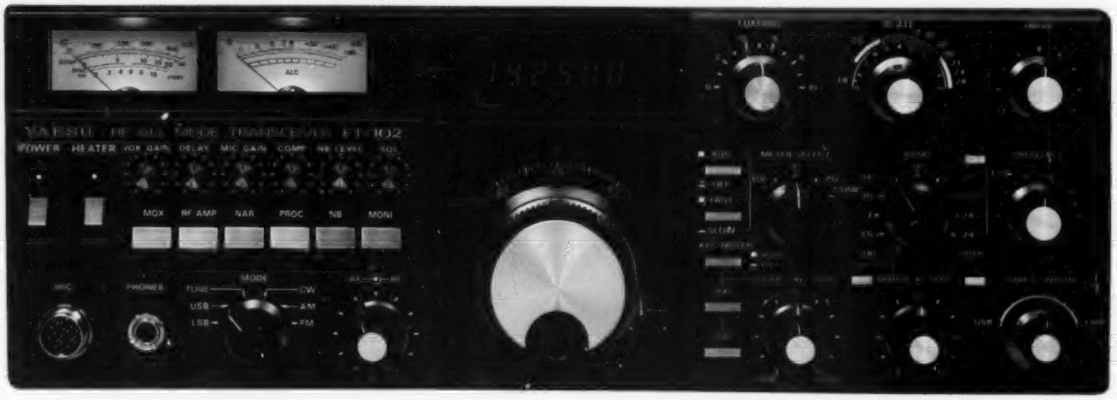
First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
# = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G/G	2 G/G	3 F/F
4 F/G	5 G/G	6 G/G	7 F/F	8 F/G	9 F/G	10 F/G
11 F/F	12 F/G	13 G/G	14 G/G	15 F/F*	16 P/F*	17 F/G*
18 F/G*	19 P/F*	20 F/G	21 G/G	22 G/G	23 G/G	24 F/G
25 F/G	26 G/G	27 G/G	28 G/G	29 G/G	30 G/G	31 G/G

New Yaesu FT-102 Series
Transceiver of Champions!



The long-awaited new generation of Yaesu HF technology has arrived! New research in improved receiver filtering and spectral purity is brought to bear in the competition-bred FT-102, the HF transceiver designed for active Amateurs on today's intensely active bands!

Unique Cascaded Filter System

The FT-102 utilizes an advanced 8.2 MHz and 455 kHz IF system, capable of accepting as many as three filters in cascade. Optional filters of 2.9 kHz, 1.8 kHz, 600 Hz, and 300 Hz may be combined with the two stock 2.9 kHz filters for operating flexibility you've never seen in an HF transceiver before now!

All New Receiver Front End

Utilizing husky junction field-effect transistors in a 24 volt, high-current design, the FT-102 front end features a low-distortion RF preamplifier that may be bypassed via a front panel switch when not needed.

IF Notch and Audio Peak Filter

A highly effective 455 kHz IF Notch Filter provides superb rejection of heterodynes, carriers, and other annoying interference appearing within the IF passband. On CW, the Audio Peak Filter may be switched in during extremely tight pile-up conditions for post-detection signal enhancement.

Variable IF Bandwidth with IF Shift

The FT-102's double conversion receiver features Yaesu's time-proven Variable Bandwidth System, which utilizes the cascaded IF filters to provide intermediate bandwidths such as 2.1 kHz, 1.5 kHz, or 800 Hz simply by twisting a dial. The Variable Bandwidth System is used in conjunction with the IF Shift control, which allows the operator to center the IF passband frequency response without varying the incoming signal pitch.

Wide/Narrow Filter Selection

Depending on the exact combination of optional filters you choose, a variety of wide/narrow operating modes may be selected. For example, you may set up 2.9 kHz in SSB/WIDE, 1.8 kHz in SSB/NARROW, then select 1.8 kHz for CW/WIDE, and 600 Hz or 300 Hz for CW/NARROW. Or use the Variable Bandwidth to set your SSB bandwidth, and use 600 Hz for CW/WIDE and 300 Hz for CW/NARROW! No other manufacturer gives you so much flexibility in selecting filter responses!

Variable Pulse Width Noise Blanker

Ignition noise, the "Woodpecker," and power line noise are modern-day enemies of effective Amateur operation. The FT-102 Noise Blanker offers improved blanking action on today's man-made noise sources (though no blanker can eliminate all forms of band noise) for more solid copy under adverse conditions.

Low Distortion Audio/IF Stage Design

Now that dynamic range, stability, and AGC problems have been largely eliminated thanks to improved technology, Yaesu's engineers have put particular attention on maximizing intelligence recovery in the receiver. While elementary filter cascading schemes often degrade performance, the FT-102's unique blend of crystal and ceramic IF filters plus audio tone control provides very low phase delay, reduced passband ripple, and hence increased recovery of information.

Heavy Duty Three-Tube Final Amplifier

The FT-102 final amplifier uses three 6146B tubes for more consistent power output and improved reliability. Using up to 10 dB of RF negative feedback, the FT-102 transmitter third-order distortion products are typically 40 dB down, giving you a studio quality output signal.

Dual Metering System

Adopted from the new FT-ONE transceiver, the Dual Metering System provides simultaneous display of ALC voltage on one meter along with metering of plate voltage, cathode current, relative power output, or clipping level on the other. This system greatly simplifies proper adjustment of the transmitter.

Microphone Amplifier Tone Control

Recognizing the differences in voice characteristics of Amateur operators, Yaesu's engineers have incorporated an ingenious microphone amplifier tone control circuit, which allows you to tailor the treble and bass response of the FT-102 transmitter for best fidelity on *your* speech pattern.

RF Speech Processor

The built-in RF Speech Processor uses true RF clipping, for improved talk power under difficult conditions. The clipping type speech processor provides cleaner, more effective "punch" for your signal than simpler circuits used in other transmitters.

VOX with Front Panel Controls

The FT-102 standard package includes VOX for hands-free operation. Both the VOX Gain and VOX Delay controls are located on the front panel, for maximum operator convenience.

IF Monitor Circuit

For easy adjustment of the RF Speech Processor or for recording both sides of a conversation, an IF monitor circuit is provided in the transmiter section. When the optional AM/FM unit is installed, the IF monitor may be used for proper setting of the FM deviation and AM mic gain.

WARC Bands Factory Installed

The FT-102 is factory equipped for operation on all present and proposed Amateur bands, so you won't have to worry about retrofitting capability on your transceiver. An extra AUX band position is available on the bandswitch for special applications.

Full Line Of Accessories

For maximum operating flexibility, see your Authorized Dealer for details of the complete line of FT-102 accessories. Coming soon are the FV-102DM Synthesized VFO, SP-102 Speaker/Audio Filter, a full line of optional filters and microphones, and the AM/FM Unit.

Price And Specifications Subject To
Change Without Notice Or Obligation

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The radio.

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MODE
CW VBT
SSB SLOPE TUNE
PITCH AF TUNE
FUNCTION
MEMORY CH
RF ATT
NB LEVEL
NB1
NB2

Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

TS-930S

The TS-930S is a superlative, high performance, all-solid state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.

Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

TS-930S FEATURES:

- **160-10 Meters, with 150 kHz - 30 MHz general coverage receiver.**
  Covers all Amateur frequencies from 160-10 meters, including new WARC, 30, 17, and 12 meter bands, on SSB, CW, FSK, and AM. Features 150 kHz - 30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN bandswitch changes in 1-MHz steps. A new, innovative, quadruple conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- **Excellent receiver dynamic range.**
  Receiver two-tone dynamic range, 100 dB typical (20 meters, 500 Hz CW bandwidth, at sensitivity of 0.25 μv, S/N 10 dB), provides the ultimate in rejection of IM distortion.
- **All solid state, 28 volt operated final amplifier.**
  The final amplifier operates on 28 VDC for lowest IM distortion. Power input rated at 250 W on SSB, CW, and FSK, and at 80 W on AM. Final amplifier protection circuit with cooling fan, SWR/Power meter built-in.
- **Automatic antenna tuner, built-in.**
  Available with AT-930 antenna tuner built-in, or as an option. Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. "AUTO-THRU" switch on front panel.
- **CW full break-in.**
  CW full break-in circuit uses CMOS logic IC plus reed relay for maximum flexibility, coupled with smooth, quiet operation. Switchable to semi-break-in.
- **Dual digital VFO's.**
  10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A=B switch for equalizing one VFO frequency to the other. VFO "Lock" switch provided. RIT control for ±9.9 kHz receive frequency shift.
- **Eight memory channels.**
  Stores both frequency and band information. VFO-MEMO switch allows use of each memory as an independent VFO, (the original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- **Dual mode noise blanker ("pulse" or "woodpecker").**
  NB-1, with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- **SSB IF slope tuning.**
  Allows independent adjustment of the low and/or high frequency slopes of the IF passband, for best interference rejection.
- **CW VBT and pitch controls.**
  CW VBT (Variable Bandwidth Tuning) control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- **IF notch filter.**
  100-kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- **Audio filter built-in.**
  Tuneable, peak-type audio filter for CW.
- **AC power supply built-in.**
  120, 220, or 240 VAC, switch selected (operates on AC only).
- **Fluorescent tube digital display.**
  Fluorescent tube digital display has analog type sub-scale with 20-kHz steps. Separate 2 digit display indicates RIT frequency shift.
- **RF speech processor.**
  RF clipper type processor provides higher average "talk-power," plus improved intelligibility. Separate "IN" and "OUT" front panel level controls.
- **One year warranty.**
  The TS-930S carries a one year limited warranty on parts and labor.

Other features:

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.

Optional accessories:

- AT-930 automatic antenna tuner.
- SP-930 external speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455-kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
- MC-60 (S-8) deluxe desk microphone with UP/DOWN switch.
- TL-922A linear amplifier.
- SM-220 station monitor.
- HC-10 digital world clock.
- HS-6, HS-5, HS-4 headphones.

More information on the TS-930S is available from all authorized dealers of
Trio-Kenwood Communications
1111 West Walnut Street,
Compton, California 90220

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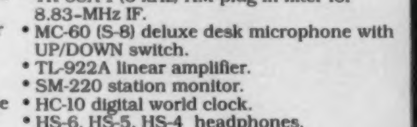

Specifications and prices are subject to change without notice or obligation.